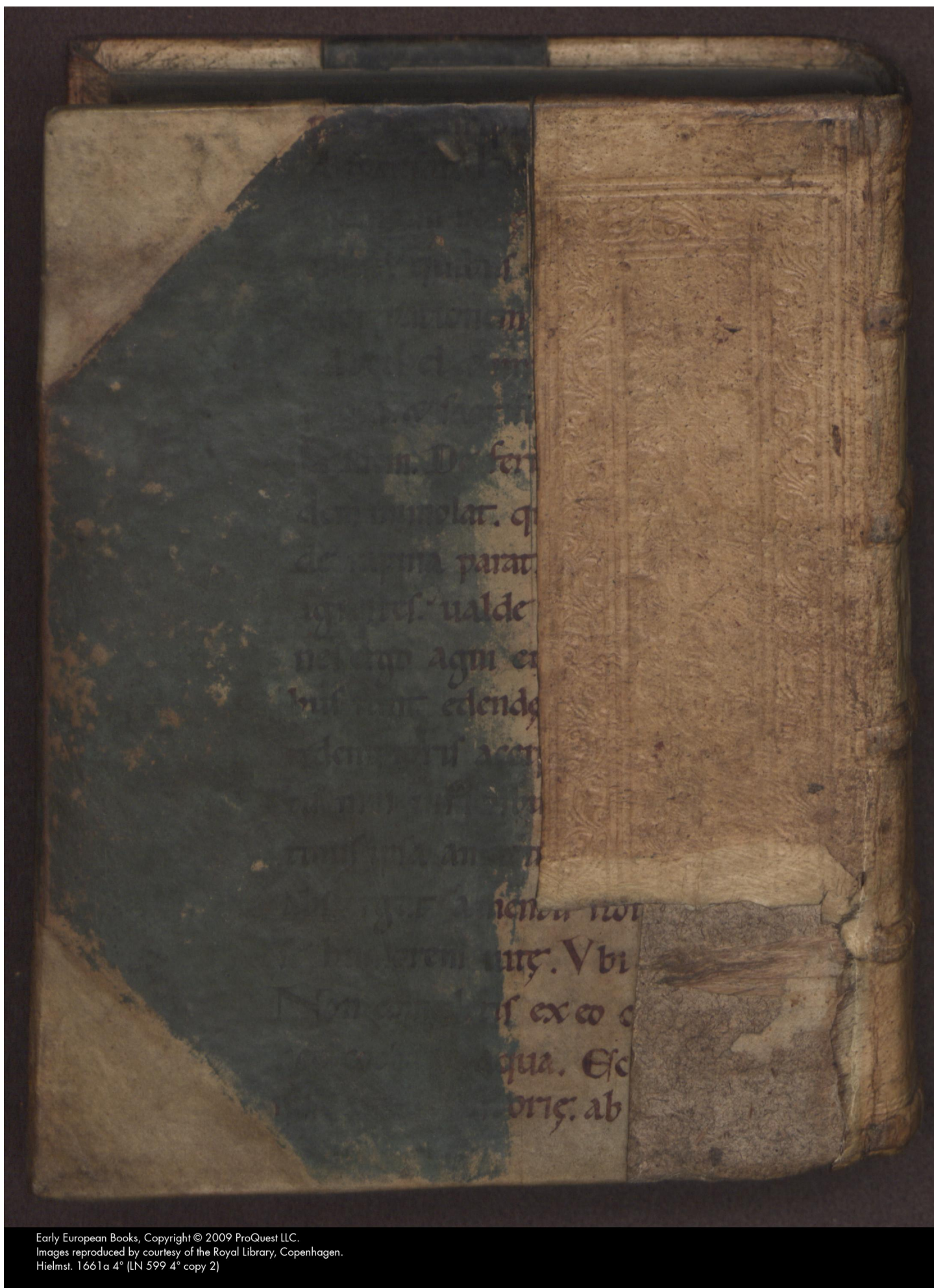






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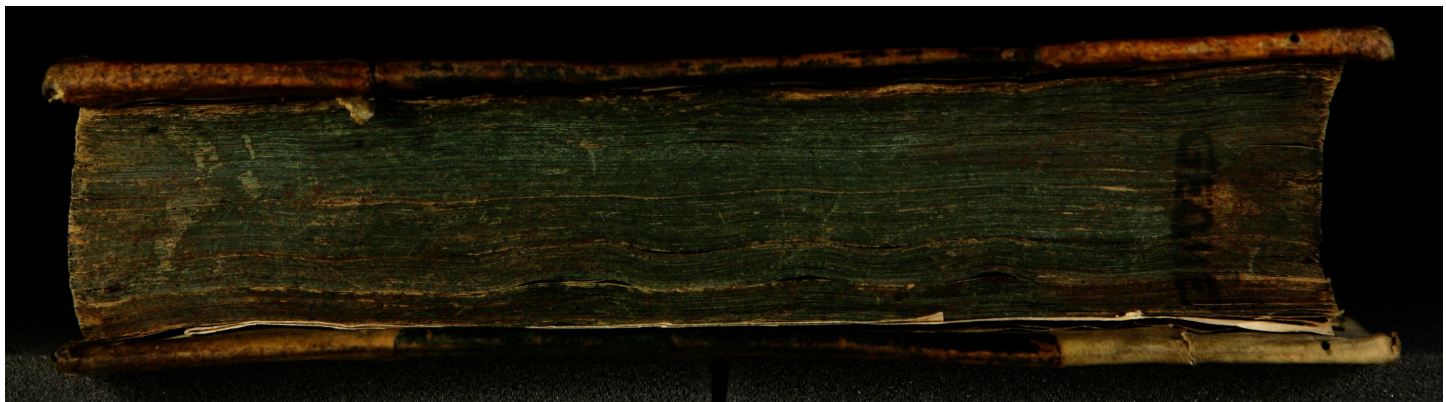




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Nº 1661.



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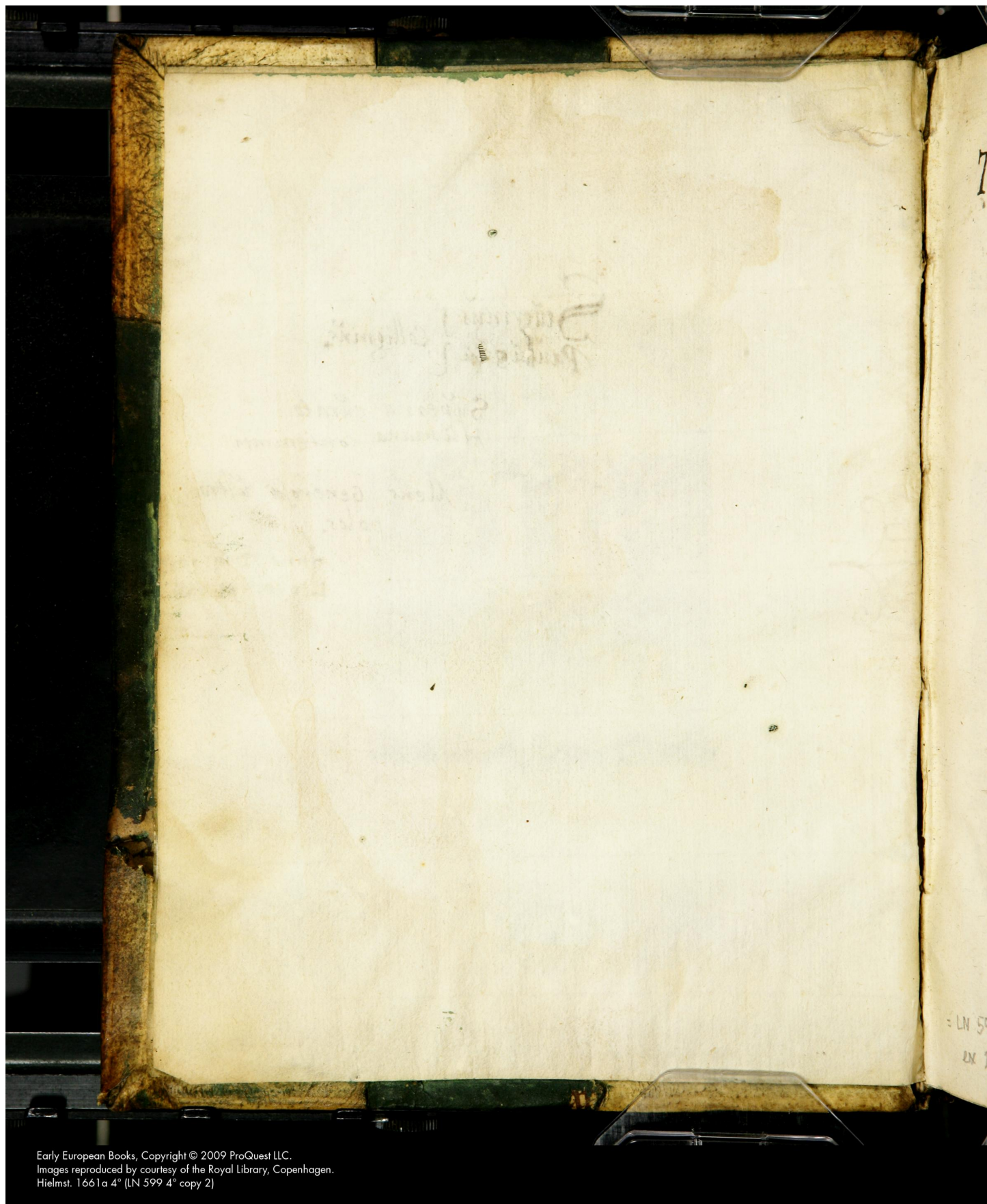


Seuerinus }
Paulus } Colligimus.

Superna curato
Humana contemito.

Mens Generosa ultra
polos.

Anno Dni 1688
Lipſiæ. M. 176.



THOMAE FINKII
Flenspurgensis

GEOMETRIÆ RO-
TVNDI Libri XIII.

Ad
FRIDERICVM Secundum, Serenissimum
Daniae & Norvegiae regem, &c.

Ex uno omnia



Christiernus Joannis
Hafniensis.
Anno MDLXX.

Cum Gratia & Privileg. Caf. Majest.

BASILEÆ,
PER SEBASTIANVM
HENRICPETRI

= LN 599
ex 2

THOMAS FINKE
Fleischburger
GOMSTRIA RO
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BASILEA
PRAESES
REINICETEL



POTENTISSIMO

PRINCIPI AC DOMINO:

FRIDERICO II:

Serenissimo Daniæ, Norvegiæ, Schlavorum Gothorumq; regi: illustrissimo Slesvici, Holsatiæ, Stormariæ ac Dithmarsici duci: Comiti in Oldenburgo & Delmenhorst, &c.

Domino suo clementissimo.



ERV M quidem est, FRIDERICE Rex, Princeps illustrissime, tritum quod fertur sermone proverbium: *Vino Vendibili suspensa hederæ opus non esse*. Ea enim rerum bonarum est natura: ut tametsi à nullo laudentur: eos tamen, qui meliore mente præditi sunt, ad se amandum excitent. Sed non minus quoque Hesiodi, Vetustissimi poëta, querela

vera est: ignorare homines quantum utilitatis atque commodi Malva & Albucum Vita humane conferant. ita enim plerique sunt affecti: ut res etiam summè necessarias & fructuosas, quia vel vulgares sunt vel ad pompam & splendorem minus accommodatae, negligant prorsus atq; contemnant.

Videre id cum aliis in rebus, tum literis humanioribus licet: maximè verò iis in artibus: quæ ob certam suam, quam pariunt scientiam hæc *ἑξω* mathematicæ solæ vocantur.

Hæ enim cum dignitatis in vita parum habere videantur, fors

¶ 2 dent

EPISTOLA

dent plerisque, & fastidiuntur: in amore contra & delitiis habentur: quæ ad questum sunt & magnificentiam comparata. Quotus enim quisque est: qui non utilissimis hisce disciplinis vel neglectis prorsus, vel obiter saltem & quasi per transennam salutatis, illico ad ea provolat studia: quæ in vulgus probantur: quæ ampla proposita habere præmia putantur: quæ ad opes & dignitates viam videntur aditumque patefacere.

At verò si rerum æstimatores paulò esse æquiores voluerimus: & dignitatem artes habere Mathematicas summam deprehendemus: & tantam in vita communi utilitatem: ut eas è societate humana qui tollunt, Solè ipsum è mundo tollere videantur.

Ecquis enim tam est ab omni historiæ cognitione instructus malè: ut Mathematicum fuisse cultores Patriarchas sanctissimos, Rerum publicæ gubernatores prudentissimos, naturæ indagatores solertissimos, non animadvertat? Abrahamum Iosephus testatur non tantum artibus Mathematicis excelluisse: sed easdem quoque Aegyptios docuisse. Idem de sacerdotibus Aegyptiacis alii referunt historici.

De Regibus verò & Monarchis, qui hæc studia vel amarunt vel excoluerunt, quid dicam? Alexandrum illum Magnum Alexandriam Aegypti Mathematicis fundasse quis ignorat? Quis Iulii Caesaris in his artibus ardorem nescit: qui

— media inter prælia semper

Stellarum cœlicum plagis superis vacasse se, gloriari apud Lucanum non veretur? Quid de Carolo Magno & eo, qui idem tecum, Rex serenissime, nomen obtinuit, Fridrico Secundo imperatore referam? quorum alter tantum in Mathematicis disciplinis profecit: ut sui temporis artificibus annumerari queat: alter tantum eas amavit: ut ex Arabum monumentis in Latinum sermonem transfundi doctrinam Mathematicam, sumptibus non parvis curarit. Longum esset omnes & reges &

Abraham Mathematica & Iosephus in Aegypto.

N V N C V P A T O R I A.

ges & principes, qui hisce operam studiis dederunt, recensere. itaq;
breuiter saltem quosdam attingere volui: ut reliquorum tibi me-
moriā, Rex serenissime, in mentem revocarem. in primis tamen
memorable istud de Carolo Quinto est: quod etiam in thermis
sedens, à studiis Mathematicis non quieuit: sed horologiis arti-
ficiosè describendis ocium fefellerit. Quin & in obsidione Vite-
bergenſi, cum in castra ad illum principes venissent, brachiis suf-
fultus tabulas inspexisse Geographicas dicitur. usq; adeo turpe si-
bi non duxit Imperator prudentissimus: etiam medios inter ar-
morum strepitus ad studia Mathematica incumbere.

jam verò ad Scholarum & Philosophorum umbracula descen-
dere si placet: quis Thaletem, quis Pythagoram, Platonem, quis
huius discipulum Aristotelem, quis alios in omni scientiarum ge-
nere Clarissimos Viros, naturaq; speculatores acerrimos, pluri-
mam in his temporis studiūq; posuisse negabit? Contra verò quis
esse audebit tam insigniter impudens: ut tanta doctrina, virtu-
te, prudentia præditos viros aut rem minus præstantem amasse
& excoluisse: aut in inutilem eandemq; non necessariam, tantum
studium tantamq; operam contulisse, affirmare non dubitet?

Certè de utilitate & necessitate harum artium si dicendum
esset: reipsa videremus: non Argum illum, qui à Poëtis fingitur,
vel decem oculorum millibus, tam acutè tamq; latè unquam vi-
dere potuisse: quam longè lateq; duobus saltem, Arithmetica dico
& Geometria, luminibus prospici queat.

ut enim taceam: quantum ambæ hæ artes & ad Opticam &
Astronomiam, ceteramq; Physicam, Medicinam, Politicam, Theo-
logiam cognoscendam docendamve adiuuenti adferant: qua-
rum quæso in agendo, siue domi siue foris, seu publicè seu priva-
tim, magis est & utilis & necessaria cognitio?

De Arithmetica fortassis alienū est hoc in loco dicere: & aliis
aliquando dabitur de hac dicendi locus.

¶

3

Ad

EPISTOLA

Ad Geometriam verò oculos convertere si velimus, quantus utilitatis sese quaso campus offert? quantus in Geodesia? quantus in Mechanicis? in cuneo, vecte, libra, cochlea? quantus in fodiis? quantus in re militari? quantus in nautica? quantus in omnium artium conservatrice Typographia? Et quis est: qui apertam in omnibus Geometria necessitatem non videat? Quod stamus: quod sedemus: quod surgimus: quod ambulamus: Geometriae usus est manifestissimus. Hinc domicilia extruuntur: hinc aedificantur urbes: hinc vestimenta nobis suppeditantur: hinc omnia tam belli quàm pacis instrumenta parantur.

*utilitates
doctrinae de
Rotundo*

Tanti autem & tam multi utilitatis rivuli, cum ex omnibus universae Geometriae fontibus, in agros nostros scaturiant: fecundissimus tamen esse videtur ille: qui ex Rotundi sese latebris effundit. Hinc enim exactissimo triangulorum calculo & machinarum instituitur secundum axes suos dispositio: & vix unquam elusa deducuntur collimationis via: imò tota hinc hostilis illa in arces & oppida irruptio optimè perficitur. Turpi clade ipse sibi ad Meliteorum urbem Philippus nocuit: quod scalas nimis breves muris admoventi curavit. idem ad Mediolanum Gallis obsuisse dicitur. Et nostri temporis plura recenseri exempla possent: odiosa ni essent. id igitur hac doctrina probe percepta vitari poterit. Hinc enim cum omnis generis magnitudines ita metiamur exactè: ut etiam in splendidissimis regum aulis notatu dignum nihil sit: quod hac dimetiri geodesia nequeamus: quid facilius quam fossarum latitudines & profunditates capere: & anguli harum recti basin investigare?

Neque vero in bello saltem vim suam Geometria Rotundi exerit: sed in pace quoque: id què multo magis. pacis enim tempore Caelestis civitatis vias exactissimè describit: sydera certis suis domiciliis distinguit: terram climatis, aliisq; ad cæli formam partibus, distribuit. Hinc ea prodierunt tabulae: in quas Alphonsus

N V N C V P A T O R I A.

phonsus Rex quadringenta aureorum millia, liberalitate fane regia insumpsisse dicitur. Hinc illis veterascentibus nova substituta fuerunt. Et hinc aliquando tandem, si ita Deo visum fuerit, nitori suo, omnium illa laudatissima scientiarum Astronomia, restituenda erit: non tam fortassis tabularum inde confectis centuriis: quàm solidis calculi Astronomici axiomatis deductis: explosa in super fictitiorum illorum circularum & orbium myriade: quæ in ipsam est naturam naturæq; opificem injuria: & sine artificio optico luci artificiosa contraria: sine Cælesti numine corporibus illis nobilibus repugnans.

Tantam potentiſſime Rex, cum viderem ex hac unica Geometria parte, in omnes artes, utilitatem redundare: & vero non ita adhuc à quoquam traditam scire: ut à studiosis hujus doctrine percipi commodè posset: rei literariæ hac in parte, pro ingenioli mei tenuitate, succurrendum esse duxi. Quæ igitur hac de re apud Regiomontanum notare, apud Copernicum perdiscere, è Ptolemaeo atque Rheinholdo haurire, è Petro Nonio aliisq; viris eximiis tam superioris quàm nostri seculi percipere, & pro quantulacumq; mea diligentia perscrutari potui: ea studiosè compertata, & pro tenui nostro judicio in præsens hoc volumen digesta, studiosis harum rerum communicare volui.

Neque verò hoc tanquam arrogantius à me dictum accipi volo. Novi ego meo me pede metiri: novi etiam quam curata mihi sit & accisa doctrina supellex. Veruntamen eo me consolor: quod qui non invidioso sunt ingenio præditi: quique publicarum sunt utilitatum studiosi: ii, si quid habent, quod commoditatem habere videtur, quaecumq; illud sit, in medium proferre solent: ut, quoad fieri possit, societati humana prodesse voluisse & etiam profuisse videantur. Ejusmodi voluntatem & ego in re fortassis levi & abjecta, utili tamen & pernecessaria declarare statui.

Sub

EPISTOLA

Sub tua autem, illustrissime Princeps, Majestatis nomine, tyrocinia mea in lucem prodire volui: non ut ignavia atq; inertia subsidium & patrocinium quærerem: sed ut quem Deus Opt. Max. patria mea longè dulcissima praesse, vel hereditario jure, illustrissimum Principem voluit: erga eum ego gratitudinis aliquod documentum relinquerem.

Quin & equum esse arbitratus sum: ut grata Mathematica suos maxime Mecænates & Patronos celebrarent. in quorum numero regiam T. M. consistere: vel insignis illa erga nobilissimum & in Mathematicis excellentissimum virum Dn. Tycho-nem Brahe magnificentia docere satis poterit: Academia verò Hafniensis nunquam tacebit. Nimirum id verè regium est, ut regni, sic virtutum paternarum heredem esse. Eodem enim animo M. T. parentem, laudatissimæ & serenissimæ memoria Principem, in Mathematicis provehendis fuisse: & res testatur ipsa: & universa agnoscit hominum literatorum corona. uterq; igitur munere suo atq; officio regio functus est probè. Duo enim in rege bono divinus ille Plato requirit: potentiam regiam & animum philosophicum. Nullum enim regnum absq; potentia diuturnum: nullum absque literis præclarum. Hac verò conjuncta cum sunt in rege: tum demum bene beateq; eos, qui subsunt, vivere necesse est. Hac igitur dno, cum & tu, Princeps serenissime, hereditario quasi jure, a parente tuo acceperis: sempiternam tibi laudem & felicitatem comparabis.

Itaq; hoc animo tuo philosophico, & hoc amore erga bonas literas earumq; cultores fretus, Rex clementissime: primitias hasce meas M. T. ea quæ par est animi submissione dono dicoq;: & ut boni consulat etiam atq; etiam rogo. Scio equidem munusculum hoc tanto rege indignum esse. Sed tamen spero qua doctrina, sapientia, clementia & humanitate prædita est M. T. libenter hoc quaecumq; opusculum & me quoq; ipsum suam in clientelam

N V N C V P A T O R I A.

telam recepturam. itaque me meaq. studia M. T. commen-
do: eiq. omnia mea officia, operas & labores offero & mancipio.
Etenim si hanc primam studiorum meorum quasi segetem non
sprevisse M. T. cognovero: frugem illi aliquando, si non opti-
mam, aliquanto tamen quam hanc meliorem & maturiorem,
Deo me bene juvante, offerre conabor.

Sed ne diutius M. T. regiam detineam: eam, cum tota il-
lustrissima Danica atque Holsatica domo, Deo ter Maximo com-
mendo: qui eam, in utilitatem Reip. cum Christianae tum politi-
ca, salvam & incolumem, fortunatam & prosperam, annos de-
inceps plurimos, conservet, tucatur, defendat. Amen. Basileae
Rauracorum anni salutis humanae M. D. LXXXIII, Mense
Septembr.

Majest. T.
addictiss.

Thomas Finck
Flenspurgensis.



TH. FIN.

TH. FINKIVS FLENS. LE

ctori philomathi ac Mathematico

S. P. D.



VM primum ego ad Mathematicas disciplinas animum appuli, Lector benevole: id mihi negotii credidi solum dari: bona via ac methodo in iisdem ut progrederer. Sed in Geometria dum versor: copiam quidem in Euclidea *σοιχεύουσα* propositionū permagnam video: methodum vero in ubertate tanta nullam, aut vix ullam videre potui. Quam id me perturbavit: quam etiam cordi meo doluerit: & ego scio: & alii, familiariter mecum qui vixerunt, non ignorant. Alia itaq; ad perscrutandam divinam hanc scientiam, via insistendum mihi putabam: cum hac successisset parum. itaque ad P. Rami me volumen Geometricum converti. inveni illicò quod in Euclide desiderāram diu. Nam & methodi sese clarissima offerebant vestigia: & ara quoq; ipsa copiosius aliquanto & luculentius instructa videbatur. Mirum, quam me res hac delectārit: & ad penitus cognoscendam hanc artem inflammārit. Quare unica lectione nō contentus: aliquoties illud legi atq; relegi: artis nimirū totius perdiscendæ cupidissimus. Aperuit mihi vir hic mentis oculos: quòd Logices usum in Mathematis egregiè monstrare est visus: Sed & ita iudicium mihi, quòd absq; tamen ostentatione dictum velim, acuit: ut tertia demum & quarta repetitio ne viderem: ipsum quoq; Ramum, cum cæteris penè satisfecerit omnibus, sibi ipsi tamen nondum satisfecisse: sed locos tantum amplissimæ hujus scientiæ compertasse atq; digessisse: quo certis eam limitibus inclusam haberet. itaque illius ego vestigia sequens: quos ille varios authores allegat: eos omnes, quotquot habere potui, cognoscere diligenter cœpi: ex iisque elementorum Geometricorum copiam conquirere: iudicio quæ logico qualicunque digerere studiosè sum conatus. Sed hic jam Epipedometrica sese offerebant: jam occurrebant stereometrica: quæ eursum laboris nostri non medio criter retardabant. Quamobrem unam mihi deligere partem, vilius est operæ precium: quam Geometriam ego Rotundi voco: usus certè in omni Mathematicarum ac Physicarum disciplinarum genere amplissimi. in qua cum mihi, hoc quidem tempore, satisfecissem: quòd amicis rectè iudicantibus satisfeceram: diutius eam apud me latere nolui: sed candide tecum, benevole Lector, communicare.

Ad *δοκίμιον* autem & structuram ipsius operis quod attinet: id cum primis operam dare conati sumus: ne quid *ἀμείβομεν*, hoc est *ὑστερον πρότερον* esset: neve aliquid aut non *ἀληθές* aut non *χρήσιμον* aut non *ἀπόδευτον*, ut cum Galeno loquar, in ele

AD LECTOREM.

in elementis ipsis assumeretur. itaq; nec Euclideanarum propositionum ordinem servare semper potuimus: nec Ramearum ubiq; connexionem retinere.

Data potestas hæc Hippocrati, data Leoni, Theudio, Hermotimo, Euclidi, Theonibus, data aliis σοιχαῖς fuit: ut ordinem propositionum in antecessoribus suis sine offensione mutarent: eademq; alio quam ipsi modo traderet. idem sibi jus majores nostri concedi voluerunt. Quotus enim quisq; Arithmeticorum etiā eorum, qui auctoritate in Scholis publica docentur, propositiones Euclideanas ordine Euclideanis disposuit? Vogelinus certè, Cæsareus olim Mathematicus, in Geometricis idē attentavit: nec unius tantum libri, sed varia variorum librorū elementa transposuit. Idem sibi licere arbitratus est Maurolycus, non in Euclide tantum: verum etiam in iis, qui posteriores Euclide fuerunt: Menelao scilicet & Theodosio. Neq; ante hos peccare sese Regiomontanus putavit: si suo atque libero judicio veterum σοιχαῖ suum in librum digereret: & quidē alio modo quā à veteribus collecta invenerat digereret.

Non ego tantis me artificibus comparo: eandem tamen, quam illi, potestatem à Lectore candido consecuturū me spero. Etenim in ea sum sententia: ut, si quid bene sit ab iis qui arte præstant: id ab aliis quoq; qui doctrina non ita fortassis excellunt, non arroganter annotari: & ad imitationem transferri posse existimem.

Nec quicquam hac ratione aut Euclidi, aut Regiomontano, aut Vogelino, aut Ramo detractum arbitror. Damus alijs hanc veniam; petimusq; vicissim: veniam tamen aureæ methodi doctrinæ consonam.

Constructionis etiam hæc cura fuit: ut ipsa tractatio certis sive capitibus sive libris distingueretur. Libros tamen potius quam capita retinere placuit, utrumq; non inimus: ob citationem propositionum antecedentium in demonstrationibus sequentiū: quæ enumeratione elementi, capitū, libri nimis futura proluxa videbatur.

Ceterum in demonstrationibus: essent ne citanda elementa Euclidean an Ramea, non nihil hæsitavi. Euclidis adducenda putabam: quod Scholarum ea ferè omnium auctoritate essent munita. At Rami tandem citanda potius esse statui: primum quidem quod hæc statim Euclidean monstrarent: dein quod præ Euclide quædā haberet Ramus: quorum usus mihi in demonstrationibus fuit necessarius: tū quod Rameæ Geometriæ hanc meam qualemcunq; operam ita sum accommodare conatus: ut circulari ea ac Sphæricæ subungi, aut cum eadem conjungi possit. Quapropter pleraq; ipsius elementa retinui: sed aliorū ea Geometrarū & novis quibusdam theorematibus adauxi itaq; ubi elementis quæ citantur additum videris Rami Geometriā intelliges: ubi vero absq; R. citata propositio fuerit: eā præsentis esse tractatus cōcludes.

Ex Menelao quoque elementa nonnulla adduco: suppeditavit etiam quædam Theodosius. Sed ego omnia ista Ptolemæo & Regiomontano nostro ascripti: propterea quod Menelaus; tametsi Messianæ sit excusus, non facilè tamen reperiatur;

✽✽ 2

Theodosius

P R A E F A T I O

Theodosius vero à Vogelino aliter, aliter à Maurolyco, aliter demum à Pena, proin-
deq; variè sit editus. Atq; hæc constructionis ratio fuit.

Porto ad figurarum picturas & lineamenta quod attinet: nō minor fortassis à me-
cura suscepta fuit. Sed earum elegantia penes me esse non potuit. Neq; vero Typo-
graphi nobis opera forsan defuisset: si sculptorem nancisci idoneum & suæ satis ar-
tis peritum potuissemus. Qua quidem re non offensum iri benevolum Lectorem ar-
bitror: si istud cogitaverit: ut non aurum est semper quod aurum splendet: sic nec for-
didum semper esse pallio sordido quod tegitur. Et minus forsan asinina leonem
pellis deformat quam asinum leonina exornat.

in cæteris verò, an id, quod maxime nobis propositum fuit, assecuti simus, penes
alios iudicium esto. Vos enim ego Lectores Logicos & Mathematicos, Mathemati-
cos, inquam, & Logicos Lectores rogo: ut candidè atq; sincrerè de hac nostra quas
licunque opella iudicetis. Si assecutus sum, quod volui, gaudeo: sin minus, ignosci
mihi cupio. sententiam emendare paratus: si ve me ipse melius docuero: si ve moni-
tus quam aliis melius quid & elegantius didicero.

Datum id summis fuit ac clarissimis in omni scientiarum genere philosophis: ut
absq; ulla nominis sui labe libros recognoscerent atq; corrigerent. Non igitur hæc
tyroni oclusa esse via debet: & fortassis, quam illis, minus.

A te itaq; Clariss. David Vvolkensteini: quia princeps mihi & ad suscipiendam
& ad ingrediendam rationem horum studiorum exististi: pro ea quæ inter nos est
amicitiæ conjunctione contendo: ut hæc mea tyrocinia tuæ submittere censuræ ve-
lis: diligenterq; pro ingenii quo polles solertia, iudicii q; acuminè examinare. po-
derare, meq; ubi opus fuerit & tibi videbitur, pro candore tuo monere ne graveris.
Nec de tua hac in re promptitudine quicquam dubito. Cum enim Mathematicis
me multis, in primis verò tibi rem me facturum esse longè gratissimam scribas: pla-
nè confido futurum: ut id re ipsa sis declaraturus.

Quin & in eadem Argentoratensiu Academia, nec te Conrade Dasypodi transire
possum. vellem tibi amice ab Astrologicis cæterisq; domesticis tantum daretur
ocii: ut hæc nostra perlegerè atq; pendere posses.

Sed & te Christiane Vrsini & te Michaël Maslæne non rogatos relinquere non
possum. peto igitur: ut quæ mihi humanitatis & benevolentia officia præstitisti: eas
dem è Musæo nostro jam avolanti metricæ ne denegetis. Nota mihi vestra in studiis
hiscæ eruditio est: nota in iudicando fides: facite quæso: ne ignota mihi vestra sit in
admonendo diligentia.

Nec te Lazare Schonere: qui vel ipso Schonerrorum nomine Mathematicus es,
difficilem mihi hoc in officio futurum arbitror.

Et quia semel hunc ego campum sum ingressus: ex eodem aliis egregiis artis
scibus non compellatis exire vix possum. qui si de facie mihi adhuc noti non sunt:
ex suis.

AD LECTOREM.

ex suis tamen, quæ in hoc studiorum genere ediderunt, scriptis innotuerunt.

Te itaq; nobilissime Dn. Tycho Brahe rogo: ut, si hæc mea etiam mare Balthicum ad te transvolarint: hospitium illis ne deneges: sed benigno vultu excipias: itaq; tractes: ut & quod boni ferat nō tegas: & quod reprehensione in illis dignū inveneris non dissimules. Facies id ob cōmunia nostra studia: facies ob cōmunem regē: Principem atq; Dominum nostrum clementissimum. Nuper in patria cū versarer, mare Balthicū salutandi tui causa trajicere cōstituerā. Sed ita illud tū sævit: ut ei me propter instantē hyemē cōmittere non sim ausus. Quæ igitur tū præsentī mihi beneficia procul dubio exhibuisses: ea absenti in Chartis hisce meis ut præstes etiā atq; etiā oro.

Pluribus hoc idem à te Dn. Thoma Diggesee peterem: si de tuo ardore in his studiis & industria dubitarem. E' scalis atq; alis Mathematicis notum mihi primum factum est nomen tuum. Fac quæso: ut sicuti scalas cælo compendiosas admovisti: sic brevissimos ad sydera in calculo accessus eligas. Quod utinam Copernici problemata præstarent. Ego enim quo pacto præsentē videre nondum possem. Tu itaq; mi Thoma judicabis: & calculum Gebri, Regiomontani, itemq; Copernici, cum eo, qui hisce in libris ex Ptolemæo atq; Rheinholdo deducitur, conferes.

Quod ab hisce, quos recensui, obtinere sum conatus: idem mihi, uti spero, ceteri quoq; artifices, ubicunq; locorum estis, tribuetis. Nominatim omnes appellare nequeo. A te tamen Dn. Thaddæe Hageci, nec non Joan. Prætori, idem sigillatim peto. Vos enim ego ob sublimem illam in Meteorologicis eruditionem miratus sum & amavi semper: sed & deinceps colam & amabo perpetuò. Ceteros ego artifices nominatim omnes persequi si vellem: & charta me & oratio deficeret. Tot enim excitarvit Deus Opt. Max. singulari sua bonitate hoc nostro seculo insignes & exercitatos in hoc studiorum genere viros: ut per censeri numerando vix possint. Quare cum difficile sit non aliquē, nefas quēquā præterire: Vos ego singulos & universos una voce appello: vestra censuræ atq; iudicio submissæ meæ subijcio. examinandaq; peramitto. Quod si morem gesseritis: libenterq; mihi hac in re gratificati fueritis nō ego

Bina dabo argento perfecta, atq; aspera signis

Pocula—

Nec tripodas geminos, auri duo magna talenta:

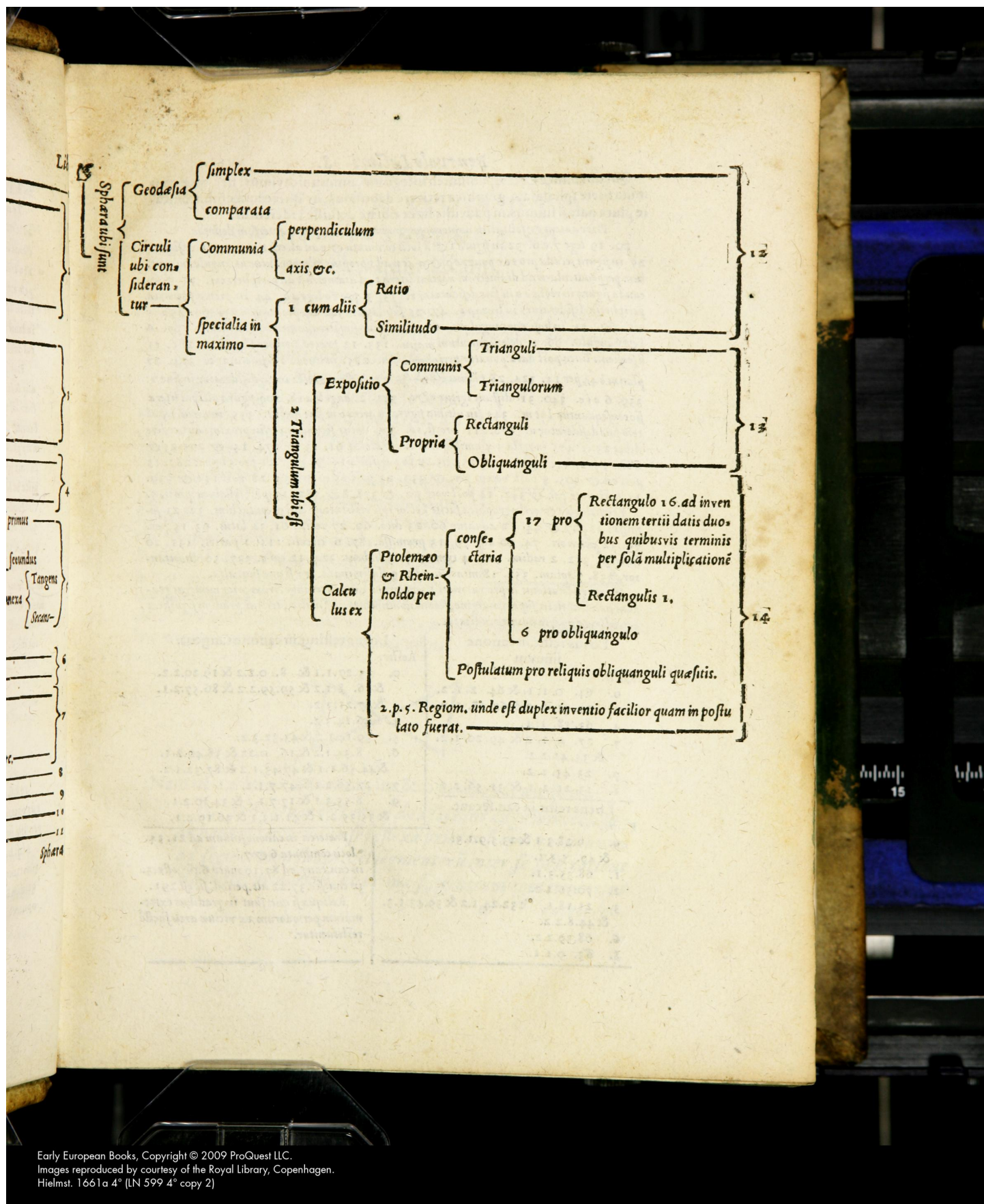
Cratera antiquum—

Sed, si eo contenti esse vultis, me ipsum vobis largiar: ad simile officiorum genus paratissimum semper habebitis: vestri studiosum experiemini semper: beneficii præstiti immemorem nunquam deprehenderis.

Atq; hic præfationis hujus finis esto: quam ipse librorum contextus insequetur: prius tamen præmissis elementis duobus: quæ tamen ad finem restituta sunt. Ea ad quintum Rami librum referenda puto: & sic deinceps citabo. valete Lectores optimi: & studiis nostris juvenilib. benignè favete. Basileæ Raurac. M. D. LXXXIII.



GEOME.



Benevolo Lectori S.

Qui tibi, amice Lector, volumen integrum communicavimus: nec quæ com-
missa fuere sphalmata graphica reticere debuimus: ut qui tecum communica-
re plura parati fuimus: in pauculis hisce tibi ne defuisse videremur.

Prior autem & solitarius numerus paginam: posterior pagine versum denotat.

20. 19 lege 7.e.6. 32 in figura i & u loci commuta & e ad alterū terminum a consigna.
25 in figura secunda pro s e e pone s e p. & a ac u ad s propius admoneantur ut angulos notent,
nam perpendicularis ad diametrum notetur literis i ad diametrum, t ad peripheriam. 33 in se-
cunda figura in recta a o in fine desideratur e. 33. 3 pro e o lege a o. 44 in prima figura in
peripheria desideratur i in linea o i. 47. 21 subdupli. 54. 14 pro a o e, o a e. 60. 25 hoc
est. 60. 44 in basi equiangulum. 68 in termino sinistro diametri desideratur a. 87. 6
l & r angulus. 96. 1 de se segmentum majus. 133. 12 precedentis prosequenti. 281. 11
e sequenti linea post data: ponatur peripheriarum. 285. in linea i o desideratur e. 324. 27
planus e 44 per 14. 324. 28 planus e $\frac{6}{1} \frac{1}{6}$. 334 in figura recta in t q desideratur in fine n.
339. 6 o i e. 340. 31 distant igitur e & c. 341. 2 anguli a i e. inq. figura ultima literæ
sic consequuntur l s t m. 345 in ultima figura in arcus o m fine deest t. 355 in arcus e y al-
tero fine desideratur u. 378. 11 pro si, si. 379 totus secundus versus proxime antecedere
debet 23.e. 405 in recta i y commissum est u. preterea 91. 13 & 274. 14. & 275 25 &
288. 5 pro i lege 1. 285. 16 & 305. 5 in particula 15 & 335. 21 pro s lege s. 287. 13
post e u. & 305. 5 post vocem per. & 333. 27 post 15.e. & 334. 28 post 15.e. & 339.
11 post vocē per. & 342. 14 post vocē per. & 378. 8 & 382. 13 post syllab. ca pro s, s.
Etymologica & orthographica facile Lectori ipse restituet ut 29. 9 contactum. 32. 21 sō-
misse. 32. 27 & 44. 12 æquatur 60. 23 dico. 60. 27 recte. 61. 34 latus. 63. 15 per.
70. 12 exteriori. 74. 30 ad. 79. 13 præmissa. 87. 6 circuli. 115. 1 partes. 131. 20
interior. 312. 2 radius. 315. 4 tum. 317. 5 habeas. 324. 12 cubo. 337. 30 dimittan-
tur. 338. 7 totam. 352. 18 minoris. 353. 9 disseminata. & si quæ sunt alia.

In loco restitutionis depravatorum numerorum canonis triangulorum prior numerus gra-
dum quadrantis in supero margine, secundus minutam in sinistro, tertius gradum significat
periodi quæ quarto numero indicatur.

Locus restit. in canone sinuum	
Restit.	
0.	64. 0. 1. 1. & 64. 2. 1. 2.
3.	14. 41. 2. 2 & 62. 18. 1. 2.
4.	63. 18. 1. 1.
1.	37. 4. 2. 2 & 49. 20. 1. 2.
	& 35. 41. 2. 2.
7.	23. 45. 1. 2.
8.	13. 21. 2. 1 & 31. 56. 2. 2.
Locus restit. in can. secant.	
Restit.	
0.	9. 28. 3. 1 & 23. 59. 1. 3.
	& 49. 5. 3. 1.
1.	68. 35. 3. 1.
2.	70. 56. 1. 2.
3.	21. 18. 1. 2 & 32. 24. 1. 2 & 39. 43. 1. 3.
	& 44. 8. 2. 2.
6.	68. 39. 2. 2.
8.	63. 9. 1. 1.

Locus restit. in canone tangent.	
Restit.	
0.	15. 27. 1. 1 & 8. 0. 2. 2 & 19. 20. 2. 2.
	& 56. 8. 1. 2 & 59. 59. 2. 2 & 86. 57. 2. 1.
	& 87. 21. 3. 2.
4.	46. 14. 3. 2.
5.	39. 14. 1. 2 & 43. 32. 3. 2.
6.	8. 34. 1. 2 & 16. 0. 22 & 38. 40. 2. 1.
	& 44. 56. 1. 1 & 47. 43. 1. 2 & 87. 32. 1. 2.
7.	27. 56. 2. 1 & 47. 7. 1. 2.
9.	8. 55. 3. 1 & 17. 7. 1. 2 & 34. 10. 2. 1.
	& 35. 35. 2. 1 & 41. 1. 3. 1 & 46. 19. 2. 1.

Preterea in canone sinuum ad 21. 34.
loci commuta 6 & 7.
in can. tang. ad 87. 19. muta 6. cū poste. 3.
in can. sec. 37. 22. ult. period. sic est 291.
Reliqua si quæ sunt in gradibus extre-
marum periodorum ex vicinis arcu facile
restituentur.

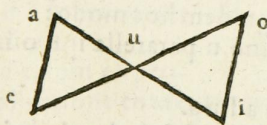
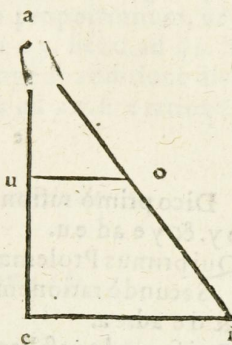
ELEMENTA DVO PTO.
LEMAICA INSERENDA AD
finem libri quinti Rami.

14.



Si duæ rectæ se secantes parallelis pluribus intersectantur: parallela segmentis conterminis sunt proportionales.

Elto sint duæ rectæ
a e. a i. sectæ à se & pa-
rallelis o u. e i. Erit ut u o. ad e i, sic a o
ad a i. Elementum veritatis suæ causam
aliā non desiderat quam per species in-
ductionem. Nec generalior demonstra-
tio dari potest. Elementum enim cuius
specialia exempla proximo genere differ-
runt generali medio demonstrari nequit.
Sufficit itaq; inductio, quod si parallelæ
sint inæquales similiter contermina seg-
menta inæqualia existere: si sint æquales
fore quoque ut segmenta habeantur æqualia: quemadmodum
hic patet in intersectis verticaliter ad u.

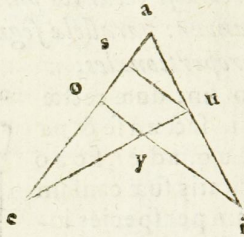


Nam ut a e & o i æquantur, ita & o u. u e. vel a u & u i.

15. *Si quatuor rectarum duæ faciant angulum, reliquæ
ab harum terminis in se reflexæ priores secant: ratio unius
ad segmentum suum, vel segmentorū inter se fit è ratione
ita conterminarum, ut prima facientium conterminetur*
a anteceden-

*antecedentis factæ principio, secunda huius consequentis
fini contermina terminetur in finem consequentis factæ.*

Sint enim quatuor rectæ a e. a i. e u. i o. quarum duæ priores
faciant angulum ad a. reliquæ ab harum terminis reflexæ secent
se in y. atq; duas priores in u & o.



Dico primò rationem i a ad a u esse factam è ratione i o ad
o y. & y e ad e u.

Qui primus Ptolemæi casus est.

Secundò rationem i u ad u a esse factam è ratione i y ad y o.
& o e ad e a.

Qui secundus est Ptolemæi casus.

Et sic deinceps plures colliges casus prout elementum habet.

Elementi autem ut & præcedentis generalis demonstratio
nulla est. Ptolemæus casus suos duos speciales demonstrat spe-
ciatim, & primum quidem hoc modo:

Ducatur à termino u paralella ipsi o i. sitque u s. Erit tum
per 14. e.

ut i a ad a u, sic i o ad u s.

Arqui ratio i o ad u s est facta è ratione i o ad o y & y e ad e u.

Ergo ratio i a ad a u ex iisdem erit facta Assumptionem hinc
probat: ex axioma illo logistico: Si numerus numeros multi-
plicet facti erunt multiplicatis proportionales: & vero assump-
pta de foris linea multiplicante o y. multiplicante inquam o i &
u s. ergò erit ratio i o ad u s. facta è ratione o y ad o i. & o y ad
s u. id est, per 14. e. y e ad e u.

Quod

Quod si hæc ad Arithmetica retuleris: prout ad multiplicationem proportionum referri debent omnia ea quæ de facta dicuntur ratione: facilis tibi in promptu erit demonstratio. Sint enim multiplicatæ proportionēs, ut i o ad o y. sic i o ad o y. hoc est, utrinq; æqualitatis ratio: & rursus y e ad e u. ut o y ad u s. per 14. e.

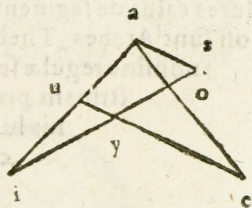
i o.	o y.	i o.	o y.
y e.	e u.	o y.	u s.

Hic quia secundarum rationum termini heterologi æquantur: erit per doctrinam multiplicationis proportionum, ut factus ab y e per i o ad factum ab e u per o y. sic i o ad u s. hoc est, doctrina multiplicationis (quæ longè ab additione differat) rationum ratio i o ad u s. hoc est, i a ad a u. fit è ratione i o ad o y. & y e ad e u.

Alter casus à Ptolemæo hoc modo demonstratur.

Ducatur rectæ e u per 3. c. 12. e. parallela a s.

Erit itaq; per 13. e. ut i u ad u a. sic y i ad y s. at assumpta deforis recta o y multiplicante ratio i y ad y s. fit è ratione i y ad y o. & o y ad y s. hoc est, o e ad e a per 13. e. Ergo ratio i u ad u a fit è ratione i y ad y o. & o e ad e a.



Poteris & eundem casum ex proportionum multiplicatione contexere, ut & primum.

Sunt enim multiplicatæ proportionēs

i y.	y o.	i y.	y o.
o e.	e a.	y o.	y s.

Ergo factus ab i y per o e ad factum ab y o per e a est ut i y ad y s. hoc est, i u ad u a.

Atq; hæc exempla hujus elementi Ptolemæus habet. Sunt vero plura:

a 2

*
 rò plura: ut & Theon ea collegit: quæ ut in promptu sint hic
 accipe.

	Facientes.		Facta.	
Antec.	ea.	oi.		
Conseq.	ao.	iy.	eu.	uy.
Antec.	ao.	ey.		
Conseq.	oe.	yu.	ai.	iu.
Antec.	ua.	io.		
Conseq.	ai.	oy.	ue.	ey.
Antec.	eo.	ai.		
Conseq.	ao.	iu.	ey.	yu.

Quæ similiter arithmetice facile demonstrantur: modo id, in
 demonstrationibus contexendis, Theonis observetur: quod
 quæ deforis assumitur sit vel parallela alteri duarum quibus in-
 terponitur, aut etiam adjungitur: vel pars alterius earundem:
 vel e contra ut altera harum sit pars assumptæ deforis. Sunt &
 plures casus de segmentis diversarum rectarum, in quibus cu-
 riosi sunt Arabes, Thebitius, Alchindus, etiam recentiores sub
 nomine regulæ sex quantitatum. Verum hi per do-

ctinam proportionum multiplicatio-
 nis hinc deducti Arithmeti-
 cæ peritos non la-
 rebunt.

TH. FIN.

T. H. FINKII GEOMETRIÆ RO- TUNDI,

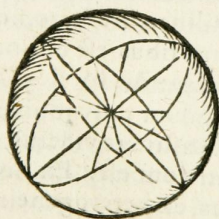
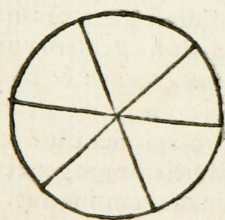
LIBER PRIMVS.

De circuli rectis secantibus.



*Rotundum est figura cujus radii omnes æ-
quantur.*

Geometria nobis proposita est rotundi: quæ benè metiatur rotundum. Hic itaque memor eorum de quibus in Præfatione dixi, necesse nō habeo plura repetere quàm ipsum subiectum mihi propositum requirit. Cum itaque Geometria proposita de rotundo sit: definiri rotundum oportuit: definitione collecta è 15. d. 1. & 14. d. 11. Eucl. Vocatur autem Rotundum pro figura rotunda: ut & vulgò planum, triangulum, quadrangulum pro plana figura, triangula, quadrangula dicimus.



Aequatio autem radiorum omnium peculiaris est rotundo. At æquantur (inquis) etiam radii parallelogrammi 3. c. 6. e. 10. R. Aequantur, inquam, sed non omnes: sed tantum ejusdem dia-
a 3 metri

metri aut saltem plures diagoniorum, aut ex angulis ductorum, aut rectè se secantium ut in quadrato: ut in figuris ad dictum Rami elementum patet. Sic & in omni multangulo ordinato radii in angulos æquantur: interim tamen non omnes radii: multi enim ducuntur in latera proindeq; minores iis, qui in angulos tendunt. Et hæc ipsa æquatio è rotundo est: quia circulus in angulis circumscribitur rectilineo.

Itaq;

2. *Diametri in rotundo bisecantur radiis equalibus.*

Ratio hujus confectarii in promptu est. Diameter enim est duplicatus radius: si ergo ex diametro auferas radium restabit radius, dimidius diametri.

Et

3. *Rotunda diametrorum equalium sunt equalia.*

Euclides speciatim de circulo proponit i. d. 3. at generale est ad omne rotundum: ut nempe rotundum rotundo sit æquale: si diameter diametro æquetur: aut radius radio.

4. *Rotundum ex isoperimetris sui generis est maximum.*

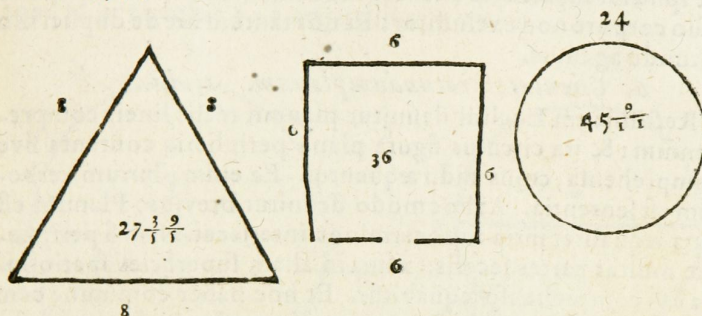
Sui generis intellige planum aut solidum: nempe planum plano solidum solido majus: Talis est circulus in planis, sphaera in solidis.

Elementi autem Veritas patet: Nam ut in planis circulus quolibet rectilineo ordinato, sic in solidis sphaera ordinatis quibilibet corporibus est ordinatio: Et sic Ptolemæus rotundum *πολυγωνίαν*: Aristoteles *ἐλκυσανίαν* vocat: & Euclides etiam esse rotundum polygoniam multorum & infinitorum angulorum 2. p. 3. astruere videtur. Et vero axioma illud & principium Geometricum est: Ex isoperimetris homogeneis ordinatis est majus, ex heterogeneis ordinatis terminatis. Principium hoc Theon à Zenodoro repetitum in Commentarijs suis in Ptolemæum, demonstrat ad caput *ὅτι σφαιροειδὴς ὁ ὅραν φέρεται* lib. 1. quod interpreti latino est secundum: & demonstrat inductione specierum demonstratarum: nec potest ejus generalior adduci

adduci demonstratio: proximo enim genere inter se specialia exempla dissident: itaq; & nos exemplis post generale allatum principium contenti erimus ad hoc propositum elementum.

Sic itaque triangulum æquilaterum, quadratum, circulus æqualis perimetri exempli gratia 24. erit hic latus trigoni 8. quadrati 6.

jam ex libris Rami per 9. e. 12. & 6. e. 11. area trianguli colligitur $27\frac{3}{4}$. quadrati 36. circuli autem aream inferius investigabimus $45\frac{9}{11}$.



Sic & in solidis sphaera isoperimetro cubo, tetraëdro, icosaëdro, dodecaëdro octaëdro major existit.

Atque hinc Plato dixit, rotundam figuram omnium esse perfectissimam: ideoque Deum mundum Sphaericum figurasse: ut suo complexu cuncta contineret.

Aristoteles etiam in Mechanicis miraculorum omnium in rotundo causam & principium ponit.

Qui sanè liber adolescentibus studiosis debet esse commendatus. Aggregent huc studiosi locum Quintiliani ex 10. c. 1. de *ἡρωεικῇ* illa: quæ ex ignorance elementi hujus existit. Qui vel propterea cognoscendus est: ut constet quanto cum pudore philosophos se jactent ii, qui elegantem hunc Geometriæ usum ignorant: cum homini etiam rhetori non sit ignotus. Et certè infiniti per omnia vitæ genera hinc errores & fraudes existunt:

stunt: si ισοπεριμετρα concipiantur ισοχονια . Hinc enim agrorum fraudulenta dimensio: Geographia mendax: cum insulae numero dierum quibus circumeuntur aut circum navigantur, mensurantur. Mensurarum profecto cylindracea quam cubica plus capit: ut quotidiana etiam plebejos experientia docuit.

5. *Rotundum est circulus aut sphaera.*

Dichotomia haec est rotundi: qua esse contenti possumus. Nullum enim praeterea rotundum est. Nam licet sphaericum, hoc est sphaerae superficies etiam rotundum sit: tamen hac divisione a suo corpore non excluditur. Et nos tantum hic de duplici illo rotundo agemus.

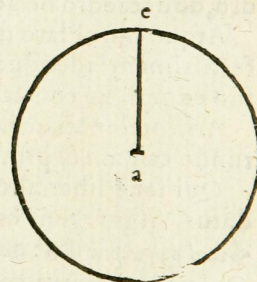
6. *Circulus est rotundum planum. 15.d.1.*

Rectilineum Euclidi definitur planum rectis lineis comprehensum: & ita circulus figura plana periphæria contenta sive comprehensa, cujus radii æquantur. Ea enim plurimum verborum est sententia. At hoc modo definitur brevius: Planum est quia æqualiter intra suos terminos interiacet. Nam si periphæriae multas partes feceris: ex una in aliam superficies spatio intra eas comprehenso æquabitur. Et hoc habet commune cum triangulo quadrangulo &c. At rotundum esse: & ab ovata figura & reliquis planis omnibus sejungit.

Describendi circuli instrumentum idem est quod fuit periphæriae: nempe circinus, sive is crura recta habeat, sive valga: sive integra, sive amputata. At ut illic motus & fluxus puncti in extremo radio periphæriam lineantis consideratus est: sic hic motus radii totam aream radiantis perpenditur. ut hic, si a e a terminis e a manente a concipias circumvolvi, donec e ad e redeat area lineata est, quæ circulus vocatur.

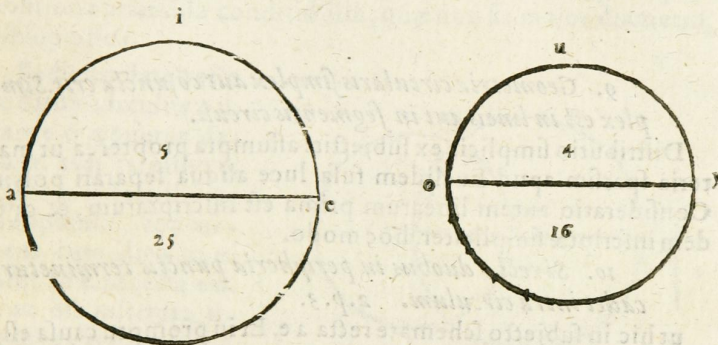
Atq; hæc de circuli definitione: circularum comparatio sequitur.

7. *Circuli*



7. *Circuli sunt ut à diametris quadrata.* 2. p. 12.

Circuli plana sunt similia: eorumque latera homologa sunt diametri. At similia plana habent duplicatam rationem homologorum laterum i.e. 6. R. Et quadrare diametros est duplicare rationem homologorum laterum. ut ex Arithmetica doctrina & ratione quadrandi diametros constat. Erit itaque sic circulus ad circulum, ut quadratum diametri prioris ad quadratum diametri posterioris. Sic circuli a i e diameter sit 5. circuli verò o u y diameter sit 4. Quadratum verò illius 25. huius 16. erit ut 25 ad 16. sic circulus a i e ad circulum o u y.



Quod si diameter esset a e quidem 14. o y verò 7. essetq; circulus major 154. minor hinc concluderetur esse $38\frac{1}{2}$. Nam quadratum de 14 est 196. de 7. est 49. jam ut 196 ad 49. sic est 154 ad $38\frac{1}{2}$.

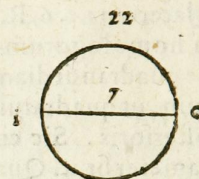
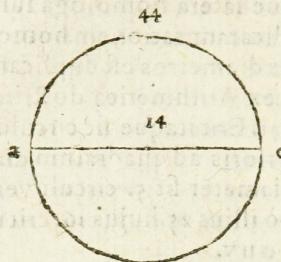
Itaq;

8. *Diametri sunt ut periphæria.*

Est Pappi theorema 5. l. 11. & 26. the. 18. ut si sint duo circuli a e. i o. Sitq; periphæria unius 44. diameter 14. alterius periphæria 22. diameter 7. erit, ut 44 ad 22. sic 14 ad 7. per hoc elementum Peucerus investigat in Geographia rationem arcuum Aequatoris ad parallelorum periphærias.

b

9. Geome-



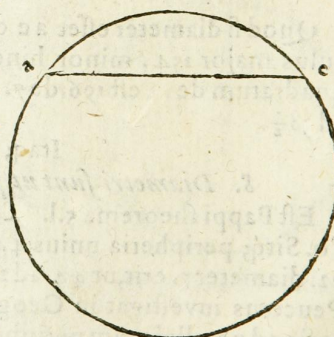
9. Geometria circularis simplex aut cōiuncta erit. Simplex est in lineis aut in segmentis circuli.

Distributio simplicis ex subjectis: assumpta propterea ut materia sparsim apud Euclidem fusa luce aliqua separari possit. Consideratio autem linearum prima est inscriptarum, & quidem inscriptarum simpliciter, hoc modo.

10. Si recta duobus in peripheria punctis terminetur: cadet intra circulum. 2. p. 3.

ut hic in subiecto schemate recta a e. Et in promptu causa est e definitione lineæ rectæ: quæ brevissima est intra eosdem terminos: brevior itaq; quam peripheria. Et certe postularum est: & postulatur ab Archimede quod lineæ, quod superficies ad easdem partes obliqua non cadat extra. 1. & 2. d. i. de sphaera. idem in isorropicis postulatur.

Theon vel Euclides impossibile adhibet ex 16 & 18. p. 1. Atq; hoc elementum docet rationem



inscripta

Inscribendæ circulo rectæ: sumptis nempe duobus in peripheria punctis. Sequitur inscriptio rectæ æqualis datæ.

11. Si à termino diametri ex eaq; radio æquante datam rectam peripheria describatur: recta à dicto termino in concursum peripheriarum inscribetur dato circulo, æqualis datæ. 1. p. 4.

Euclides mechanicè sive proplematicè proponit: in datum circum datæ rectæ, quæ non major sit diametro circuli, æqualem rectam applicare: intellige tamen inscribere: & cognita propositione præmissa conditio illa, quæ non sit major diametro, est superflua.

Sed esto data recta

a. datus circulus e u.

jam e o æquetur da-

tæ a. atq; termino e.

radio e o describatur

peripheria, concur-

rens cum dato in u.

atq; ab e. sit recta e u.

hæc est inscripta æ-

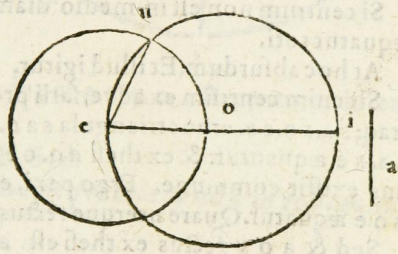
qualis datæ. Nam e u

& e o hoc est ex fabrica recta a. sunt radii ejusdem peripheriæ.

Ergo æquantur per 5. c. 5. e. 5 R.

Sequitur jam inscriptarum Coryphea diameter: cujus hæc

est inventio.



12. Si inscripta rectè bisecet inscriptam: est diameter circuli, eiusq; medium centrum. 1. p. 3.

Partes elementi duæ sunt de diametro, de centro. Esto inscripta a e. eamq; rectè bisecet per 7. e. 5 R. recta i o u in o. Erit i o u. circuli diameter. Nam inscripti rectanguli diameter communis est circulo: At hanc inscriptā bisecans est diameter rectan-

b 2 . guli

guli per 3. e. 11. R. Nam bisecta est pro latere rectanguli, & subten- dit etiam bisectam peripheriam: quibus oppositæ & inscripta & pe- riphæria perinde bisecantur. At- que ita causa communis est cum 3. e. 11. R.

Sequitur secunda pars de cen- tro: quod in medio diametri patet esse per 3. c. 5. e. 5. R. & 2. e. in me- dio enim radii secantur æquales.

Euclides impossibile maluit, & ita cogit: quæ est deductio ad sententiam absurdam.

Si centrum non est in medio diametri, sed alibi extra: pars æquatur toti.

At hoc absurdum. Et illud igitur.

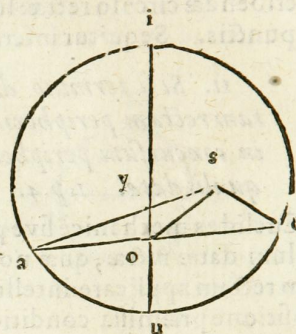
Sit enim centrum ex adversarii proposito extra y in s. ducatur itaq; s a s o s e. erunt triangu- la s a o. s o e æqualiter. radii enim s a. s e æquantur: & ex thesi a o. o e æquales sunt: s o autem la- tus existit commune. Ergo per 1. e. 7. R. angulus s o a. angulo s o e æquatur. Quare uterque rectus est per 8. e. 5. R.

Sed & a o y rectus ex thesi est. anguli autem recticruri recti sunt æquales: quare & angulus a o y. æquabitur angulo a o s. pars toti.

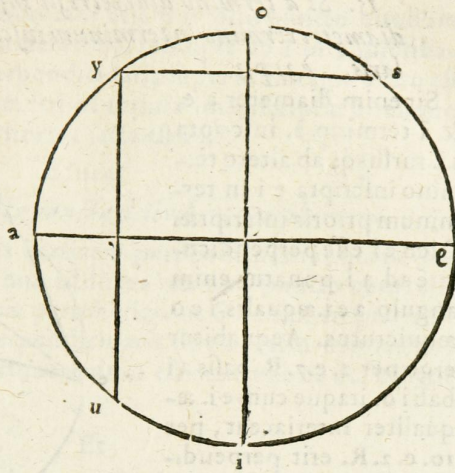
Et sic de reliquis punctis: Verum tamen si quis opposuerit esse quidem centrum in diametro, at nō in medio diametri: im- possibile Euclideum de angulis ad o non sufficit: quia tum an- guli s o a. y o a revera æquabuntur. Verum objectio est contra thesin: datur enim circulus: circulus est rotundus: rotundum au- tem bisecatur radiis æqualibus, & hic centrum est.

Itaq;

13 Si due rectæ duas inscriptas non parallelas rectè bi- secant: concursus bisecantium erit centrum circuli. è 25. p. 3. Sint



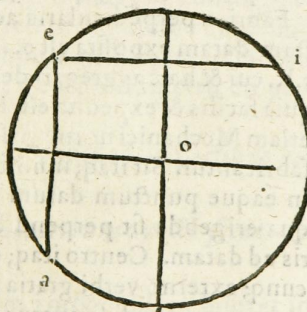
Sint inscriptæ duæ
non parallelæ yu. &
ys. Non parallelæ in-
quam. Si enim paral-
lelæ essent: jam una
recta bisecās alteram,
reliquam etiam bise-
caret, ut in præmissa
patuit, & ita concur-
sus non fieret: aut si
concurfus dicendus,
is fieri tūm possit ex-
tra medium licet ut
diametro. Has itaq;
inscriptas bisecent re-
ctæ a e. i o. itaq; erunt
per 12. e. diametri: & proinde per 3. c. 5. e. 4 R. centrum in ea-
rum erit concursus.



Et licet

14. Peripheriam ducere per tria puncta in rectam mi-
nimè cadentia.

Postulati fabrica ex 13 e. faci-
lis est. Rectas enim inter bina
puncta inscriptas bisecantes
duæ in concursu suo centrum
habent. Radius est à concursu
in punctum. Dentur tria pun-
cta a e i. quæ non cadant in re-
ctam. per ea describenda sit pe-
ripheria. rectas itaq; e i. a e. bi-
secent duæ concurrentes in o.
ubi centrum.

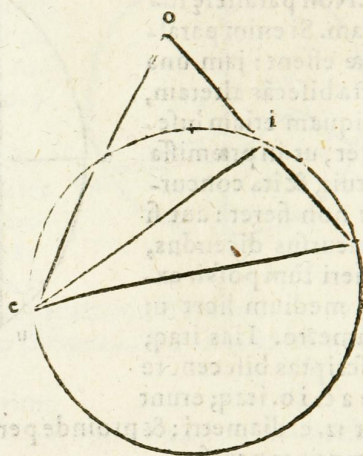


b 3

15. Si

15. Si à termino diametri sit inscripta: recta à reliquo diametri termino in terminum inscripta, ei est perpendicularis. è 31. p. 3.

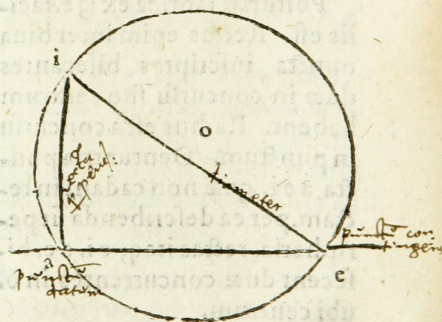
Sit enim diameter a e, & à termino a. inscripta a i. rursusq; ab altero termino inscripta e i in terminum prioris inscriptæ. Dico ei esse perpendicularē ad a i. ponatur enim angulo a e i. æqualis i e o æquicrurus. Aequabitur ergo per 2. e. 7. R. basis a i basi i o. itaque cum e i. æqualiter interjaceat, per 10. e. 2. R. erit perpendicularis.



Itaq;

16. Si recta infinita secetur à peripheria externi centri in punctis dato & contingente, & diameter sit à contingente: recta à dato puncto connectens diametrum erit perpendicularis super infinitam.

Fabrica perpēdicularis ad rectam datam exposita est 9. 10. e. 5. R. cui & hæc aggregari debet: quia facilis & expedita est. Hinc etiam Mechanici normam suam fabricantur. Sit itaq; infinita a e in eaque punctum datum a. ex qua erigenda sit perpendicularis ad datam. Centro itaq; quocunq; externo verbi gratia ad o. radio vero o a. describatur peri-



pheria

pheria secans rectam infinitam etiam in alio puncto quolibet e. jam ab e per o sit diameter e i. rectaque ab i in a inscribatur. atque hæc i a est perpendicularis super infinitam. Nam est inscripta à termino diametri in terminum inscriptæ à reliquo diametri termino: & ita norma facta est i a e.

Et licet

17. *Per duo recte puncta describere peripheriam.*

Nam recta connectens verticem perpendicularis (quam Ramea fabrica inventam huc adduces) ex uno puncto cum reliquo est diameter optatæ peripheriæ. ut si dentur in præmisso schemate a & e. perpendicularis sit a i. recta connectens i & e est diameter, in cuius medio est centrum o. describendæ peripheriæ.

Et

18. *Si recta à dato puncto faciens angulum cum infinita fiat diameter peripheriæ secantis infinitam: recta à dato puncto connectens segmentum infinitæ cum diametro erit perpendicularis super infinitam.*

Alia hæc est perpendicularis fabrica. ante punctum datum fuit in recta infinita: hic extra datur. ut si detur in eodem præmisso schemate i. tumque recta i e faciens angulum cum infinita fiat diameter peripheriæ secantis infinitam in a. jam recta à dicto puncto i. connectens segmentum a e cum diametro est perpendicularis super infinitam.

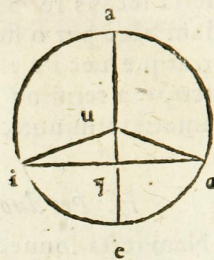
Sequitur inscriptarum comparatio, & quidem in partibus ratio primo æqualitatis.

19. *Si diameter bisecet adiametrum: rectè secat: & contra. 3. p. 3.*

Esto, diameter a e secet adiametrum i o & quidem bisecet in y. dico etiam secare rectè. Ductis enim radiis u o. u i. Triangula fiunt

sunt æquilatera: ob æquales radios: æqualia segmenta ex thesi: commune segmentum diametri u y.

Si æquilatera per 1. e. 7. R. anguli ad y utrinque æquantur: Si æquantur, segmentum diametri u y. & proinde ipsa diameter recta ac perpendicularis est ad diametro per 10. e. 2. R.



Conversa perinde facilis est: quod, si diameter recte secet adiametrum, bisecet. Nam

Triangula æqua angulo æquicrura sunt æquibasia 2 e. 7. R.

At triangula i u y. y u o. æqua angulo æquicrura ad u existunt. Nam anguli ad y sunt recti ex thesi, & ideo æquales per c. 8. e. 3. R. & rursus anguli i & o. in triangulo i u o. per 10. e. 6. R. sunt æquales. itaq; reliqui i u y. y u o æquantur. & sunt æquicruri quia i u. u o. radii sunt, & u y commune crus existit.

Ergo triangula i u y. y u o. æquantur basibus i y. y o. bisegmentis nempe rectæ recte per diametrum sectæ.

Sequitur partium inscriptarum ratio inæqualitatis.

20. Si adiametri interfecantur: segmenta sunt inæqualia 4. p. 3.

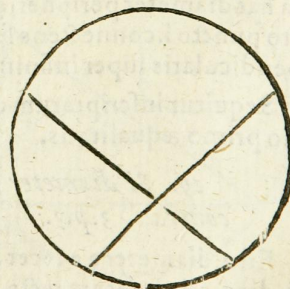
Euclides negatione proponit non fore segmenta æqualia: & demonstrat per impossibile 19. e. Verum res impossibili hoc non multum habet opus.

Nam

Si inscriptæ sunt bisectæ sunt diametri. 2. e. At inscriptæ non sunt ex thesi diametri.

Non ergo bisectæ, sed inæqualiter sectæ.

Et sic ratio in partibus inscriptarum fuit; sequitur in iisdem proportio & quidem suo effecto significata.

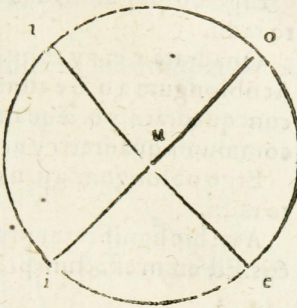


21. Si

21. Si duæ inscriptæ interfecantur: rectangulum è segmentis unius aequatur rectangulo è segmentis reliquæ. 35. p. 3.

Inscriptæ enim a e. i o. interfecantur in u.

Erit rectangulum a u. u e rectangulo o u. u i. æquale. Nam intersectæ sunt diametri aut adiametri. Si diametri jam radii erunt æquales & proinde laterum æqualium æqualia quadrata.



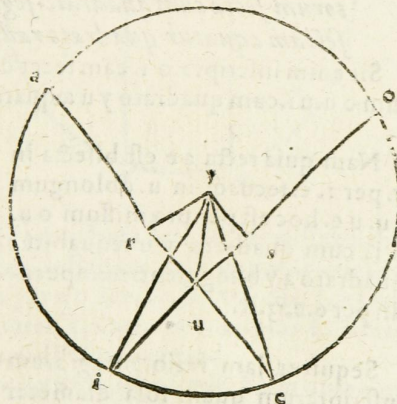
Sed si sint adiametri. cadat diameter in communem sectionem y u. Sintq; perpendiculares y s. y r. Hic per 19. e. bifecantur a e. i o in r & s. jam syllogismus demonstratio- nis hic est.

Aequalia eidem inter se æquantur:

At oblongum a u. u e. & oblongum o u. u i cum y u quadrato comuni eidem radii quadrato æquantur.

Ergo abjecto communi quadrato y u oblongum a u. u e æquatur oblongo o u. u i. Assumptio hinc pater:

Quadrata i s. s y æquantur quadrato radii i y. per 5. e. 12. R. At oblongum o u. u i. cum quadratis y s. u s hoc est cum quadrato y u.



eo yu æquatur quadratis $i s$. sy. per 6. e. 13. R. & quadrati $y s$ communis utrinq; additione.

Ergo oblongum ou . u. i. cum quadrato yu æquatur quadrato radii.

2 Quadrata re . ry . æquantur quadrato radii ye . per 5. e. 12. R. At oblongum au . u. e. cum quadratis ru . ry . hoc est per 5. e. 12. R. cum quadrato yu . æquantur quadratis re . ry . per 6. e. 13. R. & communis quadrati ry utrinq; additione.

Ergo oblongum au . u. e. cum quadrato yu æquatur quadrato radii.

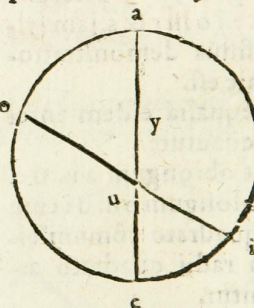
Atq; hic significatur proportio partium inscriptarum ex effectis. Est enim effectum proportionis dicta æquatio.

Itaq;

22. Si diameter secet inscriptam: rectangulum segmentorum sectæ cum quadrato segmenti diametri à centro in sectam æquatur quadrato radii. 14. p. 3. Regio. Almag.

Sic enim inscripta oi . eam secet diameter ae . dico rectangulum ou . u. i. cum quadrato yu æquari quadrato radii ay .

Nam quia recta ae est bisecta in y . per 1. e. secusq; in u . oblongum au . u. e. hoc est per præmissum ou . u. i. cum quadrato yu æquabitur quadrato ay bisegmenti nempe radii per 6. e. 13. R.



Sequitur jam ratio integrarum inscriptarum quam sola diameter totam facit.

23. Inscriptæ æquidistant à centro, in quas à centro perpendiculares sunt æquales. 4. d. 3.

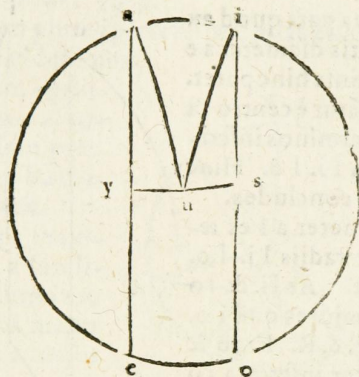
Sic

Sic a. e. i. o æquidistant à centro: quia perpendiculares in eas u. y. u. s sunt æquales.

24. Si inscriptæ sunt æquales: æquidistant à centro: & contra. 14. p. 3.

Hoc Euclides æquè potuisset postulare benè ut superius: ac demonstravit: hoc modo.

Sint inscriptæ æquales a. e. i. o. jam ducantur à centro u & radii u. a. u. i & perpendiculares u. y. u. s. Quare inscriptæ bifecantur: ideoq; & dimidia æqualiū y. a. i. s æquabuntur. Nam proportionalia ad idem five æquale æquantur. jam quadrata radiorum per 5. e. 12. R. æquantur binis quadratis crurum a. y. u. & i. s. s. u. quæ bina ideo æquantur: ablati scilicet radiorū quadratis æqualibus: denuo quæ quadrata a. y. i. s. æqualia ex thesi, sunt enim laterum æqualium, tollantur. relinquuntur quadrata adeoque ipsa latera y. u. u. s per 2. c. 2. e. 12. R. æqualia. Latera autem hæc sunt perpendiculares à centro in inscriptas ex fabrica. Ergo per 23. e. inscriptæ æquidistant à centro.



Conversa eodem ratiocinio probari poterit. Nam quia æquidistant inscriptæ à centro. erunt perpendiculares y. u. s u æquales: jam rursus ablati quadratis radiorum & perpendiculiū sigillatim æqualibus relinquuntur quadrata æqualia, & proinde latera a. y. i. s. proinde & horum dupla sunt æqualia, quæ sunt ipsæ inscriptæ.

c 2 25. Inscri-

25. *Inscriptarum inequalium diameter est maxima : diametroq; propior major remotiore, remotissima minima: minimaq; propior minor remotiore, duæq; utring; à diametro solæ æquantur. è 15. p. 3.*

Hic quinq; elementi partes habemus quas ut ordine demonstramus hoc nobis schema præmittatur, ubi diameter inscripta sit cum alijs inscriptis.

Prima pars quod ex inscriptis diameter a e sit maxima hinc patet.

Ducatur è centro radii in terminos inscriptarum l i. l o. Hinc jam ita concludes.

Diameter a l e. æquatur radijs l i. l o. per 2. e. At l i. & l o sunt majores quàm i o. per 6. e. 6. R. Ergo & diameter inscripta i o major est.

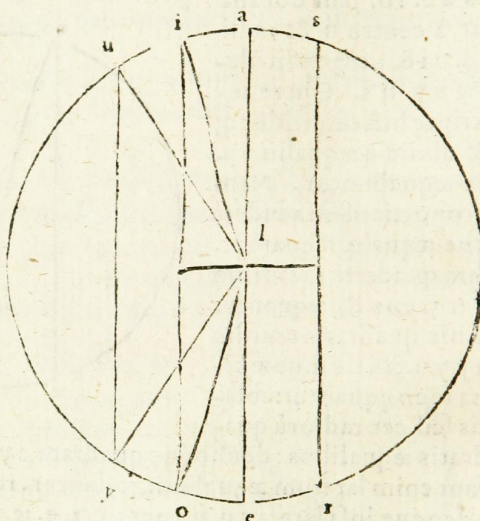
Secunda quod propior maximæ exempli gratia i o. sit major remotiore u y patet per 4. e. 7. R.

Nam

Triangulum i l o. est æquicrurum triangulo u l y. quia radii æquantur: sed interim angulus i l o angulo æquicruro u l y est major tanquam totum parte. Ergo & basis i o superat basin u y.

Tertia quod remotissima sit minima, & quarta quod propior minimæ minor sit remotiore consequuntur è prima & secunda. Nam si diameter est maxima: à diametro remotissima erit minima.

Quinta quod duæ solæ utring; à diametro æquantur per secundam



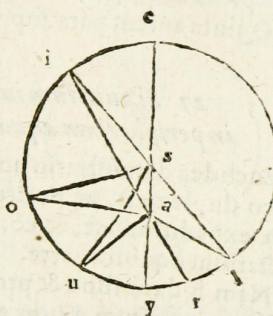
cundam patet. Nam si præter $i o$ & $s r$ statuatur tertia æqualis erit eadem inæqualis. Nam diametro propior aut remotior. At hoc est absurdum.

26. Rectarum à diametri puncto non centro, quæ per centrum est, maxima est: propiorq; maxime major remotiore: reliqua maxima minima: minimaq; propior minor remotiore: duæq; utrinque ad idem diametri segmentum è dicto puncto solæ æquantur. 7.p.3.

Propositionis hujus etiam plures partes sunt, quas etiam ordine in sequente schemate videbimus.

Prima pars quod rectarum è puncto diametri a . maxima sit $e a$. eodem modo patet quo prima præmissi. Nam $i s$. $s a$. hoc est $e s a$ majora sunt quam $i a$. per 7. e. 6. R.

Secunda quod $i a$ propior maxime major sit remotiore $o a$ similiter constat. Nam triangulum $i s a$. æquicrurum triangulo $o s a$ majus est angulo. Ergo & basis $i a$ major est basi $o a$.



Tertia, quod reliqua maxime $a y$ sit minima patet. Nam Reliqua æqualis de inæqualibus, datis similiter directè sunt inæqualia. quod axioma Arithmeticum est.

At $a y$ & $a u$ sunt reliqua æqualis nempe communis $s a$ de $s a$. $a u$. & $s u$ hoc est $s y$ inæqualibus. per 7. e. 6. R. Nam $s a$. $a u$ majora sunt quam $s u$. Ergo similiter sunt inæqualia datis inæqualibus & $a u$. major quam $a y$.

Quarta pars, quod minime propior $a u$ sit minor quam $a o$ remotior patet per 4. e. 7. R. Nam triangulum $o s a$. æquicrurum triangulo $u s a$. est majus angulo. Ergo & basis $o a$. major est quam basi $u a$.

Quinta quod duæ utrinque ad idem diametri segmentum è dato puncto æquantur patet. nam si angulo $u s a$ sit æqualis $a s r$.

c 3 & latera

& latera u s. a s. & a s. s. sunt æqualia: per 2. e. 7. R. u a. a. æquabuntur: Et quidem solæ æquantur, ut impossibili constat. Si enim nō solæ. Sit ergo a l æqualis tertia. ergo per 1. e. 7. R. angulus l s a æquatur angulo r s a. totum videlicet parti quod est absurdum. Euclides ait ad utramque partem minimæ solas duas æquari: at id tamen commune est ad utramq; partem etiam maximæ.

Elementum itaq; generale est de puncto quocunq; diametri extra centrū: siue in diametro sit, siue in termino diametri (quod speciatim Commandinus demonstrat ad 8. p. Archimedis de lineis spiralibus) si hic notetur minimam in diametro tum non esse proindeq; nec inde utring; æquales. Quæ per se patent.

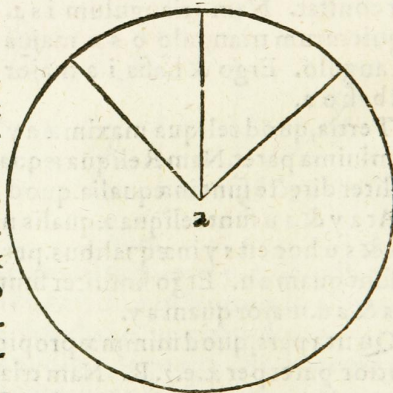
Quinta autem pars suppeditat nobis confectarium aliquod.

Itaq;

27 Si punctum in circulo est terminus trium rectarum in peripheriam æqualium: est centrum circuli. 9. p. 3.

Euclidea demonstratio hoc loco duplex est. at postrema expeditior est, & confectarium è quinta parte.

Nam si datū illud & propositum punctum a non est centrum, à diametri (quæ per quodlibet in circulo punctum duci potest) puncto nō centro nō solum duæ utringue æquantur: quia hic ex thesi dantur tres æquales ab eodem puncto. Quod tamen contra 26. e. cuius veritas constat, infertur.



28. Rectarum à dato extra puncto in concavum peripheriæ quæ per centrum est, maxima est: propiorq; maxima

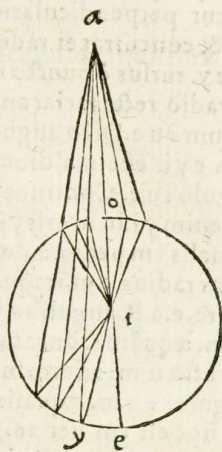
ma maior remotiore in convexum segmentum maxima est minima: minimeq; propior minor remotiore: duag; utring; a maxima vel minima sola equantur. 8.p.3.

Elementi partes totidem sunt quot fuerunt 26.e. & demonstratio simillima.

Exempli gratia prima pars est, quod à dato extra puncto per centrum in concavū peripheriæ sit maxima, nempe a o e ea patet. Nam recta à dicto puncto in centrum a i. & radius in terminū extra centrum inscriptæ i y. sunt maiores dicta inscripta per 7.e.6.R.

Reliquas partes eodem modo con-
texes: quas tuæ diligentiae relinquo.

Habuius rationes rectarū à puncto interno & externo inscriptarum: Eæ angulos faciunt cum diametro: radiis: aut inter se: quorum rationes inter se hic considerare utile & proprium fuerit.



29. Angulorum rectarum è diametri puncto non centro atque radiorum, maximus est recta perpendicularis ad diametrum: maximoq; propior maior remotiore: quaterniq; inscriptarum per datum punctum aequalium duarum & cum radiis & cum diametro equantur: biniq; utring; à diametro equidistant à radiis & segmentis inscriptarum aequalibus comprehensi.

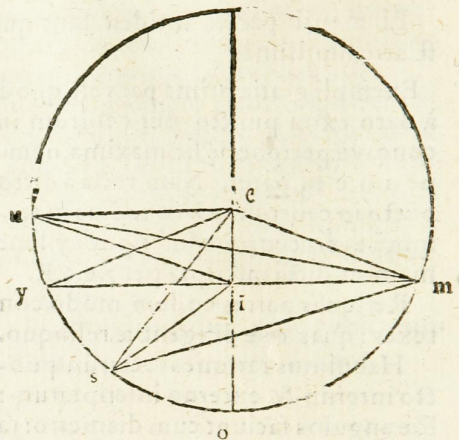
Hoc elemento hypothesium fabricatores nobilissimam illam astrorum scientiam penitus obruerunt: At nos ab exilio in patriam revocare statuimus: nec ita miserè ad prosthaphæreses planetarias esse astringendum, sed domum esse reducendum: quo aliis etiam suam operam communicare possit.

Elementi

inter angulos ad p.
phenam circumq; consti-
tutos a rectis o dia:
metri puncto non
centro eductis, & ra-
diis, max e is, q con-
stituit a radio &
recta diametro p pen-
diculari: Nro ppior
è major remotiore,
& quatuor anguli ex
moti facti a t angu-
lis radiis & duab; re-
quib; inscriptis in di-
ametri puncto se in-
tersecantib; equantur,
veluti etia illi aequalis
st, q a dictis inscriptis
& diametro constabu-
unt. Deniq; bini nam
q a diametro ad
distant, à radiis &
segmentis inscriptam
equalib; comprehensi.
Al: dem: l: apd Coppiu.

Elementi igitur partes ordine videbimus: prima pars quod angulus maximus sit è radio & perpendiculari ad diametrum in qua punctum datum est.

Sit diameter e i o. ex ejusque puncto i egrediatur perpendicularis i y. & concurrat ei radius e y. rursus è puncto i. cū radiō recta faciat angulum i u e. Dico angulum e y i. esse majorem angulo i u e. Continuetur enim y i. in m erit y i. æqualis i m per 19. e. ducatur radius e m. itaque per 10. e. 6. R. anguli ad y & m. æquatur. ducatur & recta u m: erit rursus angulus e u m. æqualis angulo e m u. & quia u i major est quam y i. hoc est i m per 26. e. etiam angulus u m i major erit angulo i u m per 11. e. 6. R. jam ex Arithmetica proportionem collige. Summæ ex inæqualibus atq; æqualibus sunt inæqualibus datis similiter inæquales.



Anguli autem e u i. e m i. ^{e. p. 2. c. 5. 7. R.} hoc est e y i. sunt summæ ex majori i m u & minori i u m. & æqualibus e u m & e m u. Ergo & c. atque e y i. major quam i u e. Et sic de aliis angulis vel proximioribus ipsi y. Nam si remotiores sint minores probabuntur ipso angulo ad u. qui & ipse minor est angulo ad y. Nec ex altera parte in fra y. poterit dari major. Sit enim angulus in fra y comprehensus à rectis e s radio & i s. dico & ipsum esse minorem quam sit angulus ad y. Ducatur recta s m. erit per 10. e. 6. R. angulus e s m. angulo e m s æqualis. Et rursus in triangulo i s m. quia i m hoc est y i est major quam i s per 26. e. erit etiam angulus i s m major angulo i m s. per 11. e. 6. R. Hinc per axioma Arithmeticum concluditur.

Reliqua

Reliqua inæqualium de æqualibus, inæqualibus sunt recipro-
cè inæqualia.

At anguli $e s i$ & $e m i$ hoc est $e y i$ sunt reliqui inæqualium ma-
joris $i s m$. minoris $i m s$. de æqualibus $e s m$. $e m s$.

Ergo & c. nempe $e s i$ minor quam $e y i$.

Atq; sic prima constat propositi pars.

Secunda pars quod propior maximo sit major remotiore.

Sit enim angulus $e y i$. pro-

prior maximo remotior vero

$e s i$. jam ducta $y u$ per 10. e. 6. R.

Anguli $e y u$. & $e u y$ æquantur.

Continuetur etiam recta $s i$ re-

cta $i u$. quæ quia minor est quam

$i y$ per 26. e. erit & angulus $i u y$

angulo $u y i$ major per 11. e. 6. R.

Hinc ita colligitur. Anguli $e y i$.

$e u i$. hoc est $e s i$. sunt reliqui ma-

joris $i u y$ minoris $i y u$. de æ-

qualibus $e y u$. $e u y$. Ergo reci-

proce sunt inæquales, $e y i$ majoris $e m i$ minor.

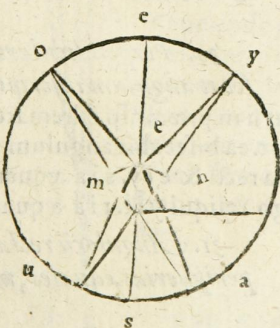
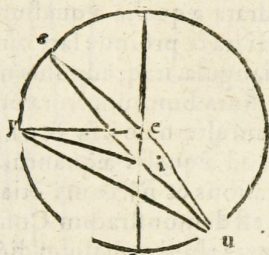
Has partes brevius demonstrant Regiomontanus, & post-
eum Nonius: Verum à posteriori per doctrinam segmentorum
circularium. Vide Epitomen Regiomont. & Annotationes No-
nii ad theoriâ solarem Purbachii.

Tertia pars quod quaterni à dua-
bus per diametri punctum inscri-
ptis æqualibus & radiis compre-
hensi sint æquales nempe anguli
 $a y o u$.

De oppositis $a o$. & $y u$. constat
per 10. e. 6. R. Nam $o e$. $e a$. item $e y$.
 $e u$ sunt æquales: quia radii.

De angulis autem o & y . vel u
& a . probatur. Quia enim æquales

d ex



ex thesi sunt inscriptæ æquidistant à centro per 24. e. itaq; perpendicularares e m. e n. æquales per 23. e. secant m o. n y æquales: quia sunt dimidia per 19. e. æqualium, & radii e o. e y æquantur. Quare triangula e o m. e y n sunt æquilatera. itaq; per 1. e. 7. R. angulus o æquatur angulo y. item q; u & a. Sic de reliquis.

Quarta: quod quaterni à distis rectis & diametro æquantur ad i. Nam in figura antecedente primo anguli verticales u i s. s i a. cum p i y. o i p æquantur. Deinde in triangulis e m i. e n i. quia e i æquepotest e n & i n. item q; e m. m i per 5. e. 12. R. ablata quadrata æqualia æqualium e m. e n. de æquali e i. relinquunt quadrata & proinde latera m i. n i. æqualia. Sunt itaq; æquilatera triangula. itaq; angulus m i e æquatur angulo e i n. & u i s & c.

Quinta: binorum crura præter radios, nempe segmenta inscriptarum alterna o i. i y & u i. i a. æquantur. Nam summæ æqualium ad æqualia æquantur. Et i o. i y sunt summæ ex. n y. m o æqualibus & n i. & m i etiam æqualibus: ut in præmissis membris est demonstratum. Constat tamen & per 26. e. hæc pars.

Sexta: bini æqualium distorum angularum o & y. item a & u utrinq; à diametro æquidistant. Nam triangula e i y. o i e sunt æquilatera, & ideo anguli y e i. o e i æquantur, atque reliqui ad duos rectos p e y. p e o. quibus anguli o & y à diametro abluunt. Sic & de angulis u & a.

Ex hac autem parte Consectarium aliquod est: quo etiam Astrologi hypothetici utuntur.

Itaq;

30. *Perpendicularis è puncto diametri non centro bisecat angulum inscriptarum per datum punctum æqualium.*
ut si in præmissis schemate à puncto i. erigatur perpendicularis i t. ea bisecabit angulum y i a. Nam e i t. t i s anguli æquantur: quia recti & e i y. s i a æquantur. id enim jam demonstratum est. Ergo reliqui y i t. t i a æquantur quare totus y i a est bisectus.

31. *Angulorum rectarum à dato extra puncto secantium peripherias æquales, maximus est cum recta per centrum: maximusq;*

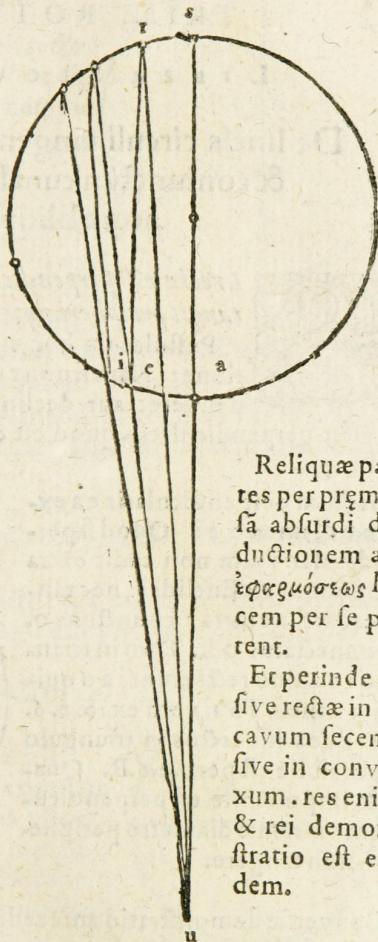
*maximōq; propior major remotiore: duōq; utring; à maxi-
mo soli æquantur.*

Et hoc elementum Epicyclīcū est Astrologis.

Esto à dato extra puncto u recta u a. quæ centrum cōtinuata transiret, u e. u i secant peripherias æquales a e. c i. dico primo angulum a u e esse maiorem angulo e u i.

Secus enim si non est major sit æqualis. si æqualis. fiant anguli u i r. u e s quoq; æquales. erūt ergo triangula æquiangula & per 9. e. 7. R. ut u s ad u r sic u a ad u i. At u s major quam u r per 28. e. Ergo & u a major quam u i. Quod est contra 28. e. Ergo angulus i u e non est æqualis angulo i u e.

Potuiſſet demonstrari alio modo (Nam hæc *ὅτι τοῦ πρὸς τοῦ* aliquid continere videtur) nempe si angulo e u a ponatur æqualis ad rectā u e. tum is æquatus continebit angulum i u e. Ergo eo est major & proinde a u e esset major eodem i u e.



Reliquæ partes per præmissā absurdi deductionem augere non possunt.

Et perinde est siue recta in cōcavum secant, siue in convexum. res enim & rei demonstratio est eadem.

d 2

TH. FIN.

T H. F I N K I I G E O M E
T R I A E R O T V N D I,

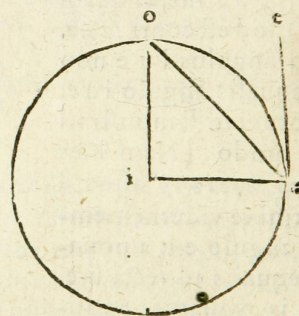
L I B E R S E C V N D V S.

De lineis circuli tangentibus sigillatim
& coniunctim cum secantibus,
atq; obliquis.

*I recta est perpendicularis extremae diametro:
tangit peripheriam: & contra. è 16. p. 3.*

Postulatum hoc esset ex perpendiculari defini-
tione: Nam si non tangeret, sed magis hac pro-
penderet aut declinaret peripheriam secaret,
nec esset perpendicularis, quod est contra thesin. Euclides ta-
men cogit.

Sit enim perpendicularis e a ex-
tremæ diametro a i. Quod si per-
pendicularis jam non cadit extra
circulum, ut ait Euclides, nec tan-
git cadat sane intra ad punctum o.
& connectatur o i. Tum in trian-
gulo i o a. duo recti erunt i a o qui-
dem ex thesi. i o a. vero ex 10. e. 6.
R. At duos esse rectos in triangulo
impossibile est per 9. e. 6. R. Qua-
re & impossibile est perpendicu-
larem extremæ diametro periphe-
riam non tangere.



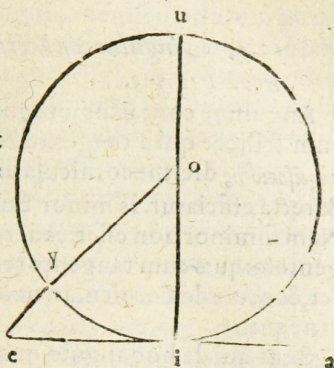
Conversæ demonstratio antecedenti simillima est.

Nam si a e tangit & tamen non est perpendicularis diame-

110

tro i o u. ducatur à centro o. alia perpendicularis o e. erit angulus o e i rectus, & o i e acutus.

jam quia acutus minor est recto erit per 11. e. 6. R. latus o i. hoc est o y. majus latere o e. pars nempe toto: quod est absurdum.



Itaq;

2. Si recta est per centrum & contractum: est perpendicularis tangenti: & contra. 18.19.p.3.

Est è conversa præmissi. Nam recta à centro in contactum vel cōtactu in centrum est pars diametri. Ideoq; ei tangens est perpendicularis &c.

Et

3. Punctum contactus est, quo à centro perpendicularis tangenti incidit.

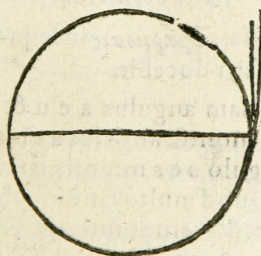
Contactus fit vnico puncto: & à centro in contactu recta est perpendicularis tangenti: ergo illic punctum contactus esse necesse est.

Et

4. Tangens est singularis eadem parte. è 16.p.3.

Consequitur ex 1.e. & 10.e.2.R.

Nam perpendicularis est ex eadem parte singularis. Et tangens est perpendicularis. ut jam patuit. Euclides proponit: quod nulla recta cadere possit inter peripheriam & perpendicularem.



d 3 Et

Et

5. *Angulus contactus est minor quovis acuto rectilineo. e16.p.3.*

Angulum contactus vulgo vocant angulum contingentiae: eum scilicet qui è tangente & peripheria continetur. Proclo *legatos* dicitur cornicularis: quia instar cornu ex peripheria & recta efficiatur. is minor Euclid i est quovis acuto rectilineo. Nam si minor non esset: caderet recta inter peripheriam & tangentem: quæ cum tangente rectilineum acutum comprehenderet, & proinde corniculari ut toto minorem: At per 4. e. hoc fieri nequit.

Sunt qui de hoc angulo quæstionem movent: cur si angulus contactus magnitudo sit, ea dividi nequeat: & cum dividi nequeat: angulum hunc magnitudinem esse negant. ideoq; semicirculi angulum recto rectilineo esse æqualem: imo quorumlibet semicirculorum angulos æquari. Sed Geometria convincit angulum contactus esse minorem acuto rectilineo quovis. Non tamen propterea minimum postulamus. secari potest & dividi Geometricè & quidem infinite: sed in divisione ad angulum rectilineum non pervenietur. Postulat Euclides in opticis angulum quidem minimum at non geometricum: sed opticum: sed physicum.

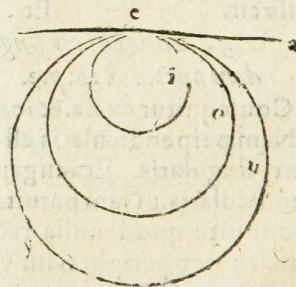
Et

6. *Anguli contactus in aequalibus peripheriis sunt æquales: in æqualium autē minoris cornicularis est major. s*

Hæc è *εφαρμογή* in sequenti figura satis docebit.

Nam angulus a e u & s e y æquantur: & angulus a e u minor est angulo o e a minoris circuli.

Quod multo fanè mirabilius quàm 5. e. & verum interim Geometria convincit.

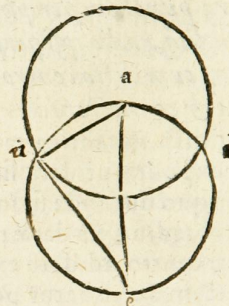


Fallitur

8. Si recta à centro data peripheriæ ad datum extra punctum fiat diameter peripheriæ: recta à dato puncto in sectionem data & descripta tangit datam peripheriam.

Sit data peripheria u. i. & datum extra punctum e. jam à centro a ducatur recta a e. quæ fiat diameter describendæ peripheriæ e u. i. sumpto nempe ejus medio pro centro.

Tum à dato puncto e ducatur recta in sectionem. e. u. dico rectam e. u. esse tangentem quæsitam. Est enim perpendicularis ad u. a per 15. e. i. at u. a est diametri datæ peripheriæ pars. Quare u. e. est perpendicularis extremæ diametro &c.



Hanc fabricâ esse faciliorem facile intelligitur collatione.

Nam Euclidea rectam à centro ducit: describit peripheriâ: perpendicularem fabricat: perpendicularis terminum connectit cum centro: à dato puncto rectam ducit. At hæc rectam ducit: rectæ semissæ radio describit peripheriam: rectam ducit. utere igitur hac fabrica in fabricanda tangente. Atq; ita secantes habuimus & tangentes seorsim: sequitur de simul utroq; genere: & quidem proportio effecto ut ante significata.

9. Si è duabus rectis à dato extra puncto prima secat in concavum, reliqua tangit: oblongum è secante & exteriori secantis segmento æquatur quadrato tangentis: etsi oblongum tale æquatur quadrato reliquæ: reliqua ipsa tangit. 36.37. p.3.

Vogelinus ex effecto causam cõsiderat nempe proportionem in rectis. Verum à posteriori per angulos in sectione alternos secantis & contiguæ. Quare nos Euclidis retinebimus demonstrationes: & effectum ex simili aliquo effecto deducemus.

Secans

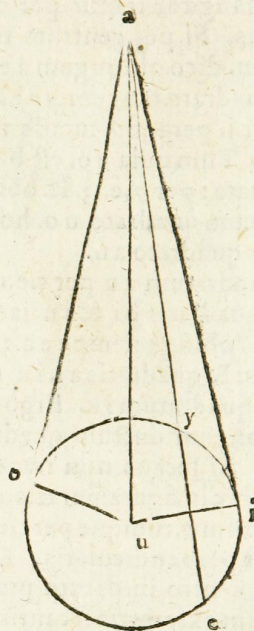
c

[illegible]

æquale quadratum relinque-
tur oblongum dictum æquale
quadrato tangentis. Et sic de
antecedente constat.

Conversa similiter demon-
stratur in adjuncta figura.

Est enim oblongum $ea ay$
æquale quadrato ai . dico ai tan-
gere peripheriam. Ducatur per
 o . e. tangens ao . item ducantur
 au . & radii uo . ui . Erit itaq; ai .
 ao . æquales. Nam oblongum
 $ea ay$. æquatur quadrato ao .
ex jam demonstratis & ai . ex
thesi. Quare quadrata & proinde
latera ai . ao . inter se æquan-
tur. Quare triangula $ai u$. $ao u$
sunt æquilatera itaque per 1. e.
7. R. angulus $ai u$. æquatur an-
gulo $ao u$. At hic rectus est.
Nam uo est perpendicularis
tangenti per 2. e. Quare & al-
ter, & proinde ai est perpendi-
cularis extremæ diametro iu . itaq; per 1. e. tangit.



Itaq;

10. *Tangentes ab eodem puncto sunt æquales.*

Nam ipsarum quadrata eidem oblongo æquantur: proinde
sunt ipsa ipsorumq; tandem latera æqualia. Nec possunt esse plu-
res duabus tangentes æquales. Est campani ad 36. p. 3. ut & Con-
sectarium sequens.

Et

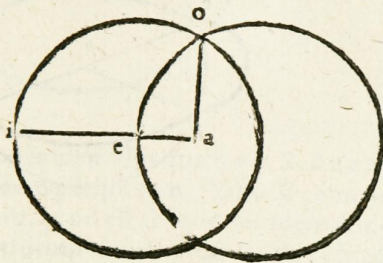
Ex hoc elemento veluti e. r. e. 13. R. licet invenire segmentum basis. 11. Oblonga è qualibet ex eodem puncto secante & se-
larem ab oppositis duobus cantis exteriori segmento æquantur inter se.

Quia eidem nempe quadrato tangentis æquantur. Et
Expositur e. 1. Sint data trianguli tui & eligatur basis. 2.
Reliqua duo latera adduntur. 3. eadem etiam latera a se in
vicem subtrahantur & reliquum e. dista crura. 4. mul-
tiplicetur dista crura in summa crura. productum dividatur
per basin & quotus annotetur. 5. crura quæ sunt minor fuerint (basis) subtrahat
a basi reliqui dimidius e. segmentum basis inter crura minoris & perpendi-
lare intercepti. Si vero quotus basis major fuerit. Quod accidit angulo ad basin
obtusum subtrahatur basis a quotus reliqui dimidius est segmentum recta a
termino basis usq; in perpendiculari recta.

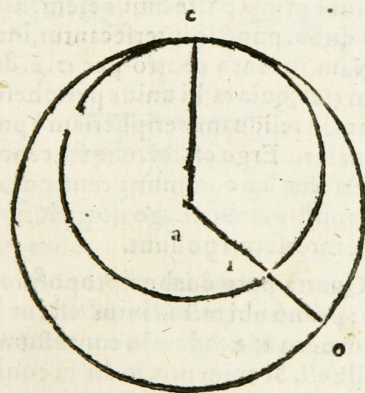
13. Si peripheriæ sunt intersectæ vel contiguæ: sunt eccentricæ: illæq; duobus tantū punctis intersectantur, hæ diametros per contactum continuant. 5.6.10.11.12.p.3.

Hæc penè omnia postulari possent: neq; enim propositionis materia potius quam principii est. Circulos enim se secantes aut contingentes vel extra vel intra diversa habere centra quis est qui dubitat? Sed demonstrationes Euclidæ ex impossibili sic se habent. Prima pars de intersectis.

Sint intersectæ duæ peripheriæ i o. o e. Quod si ergo commune centrum habent: sit sane a. Erunt itaq; a o. a e æquales. itemque a o. a i. per 2. e. 1. & quia e a. a i. eidem æquantur: inter se æquantur. nēpe pars toti. Quod est absurdum.



Eadem demonstratio est de contiguis ut in sequenti figura. si ponas commune centrum a. erit a i. æqualis ipsi a o. quia eidem a e radio æquantur. at hoc est partem equare toti: quod absurdum est. Si peripheriæ sint foris contiguæ res expeditior est: neq; demonstrationē Euclideam meruit.

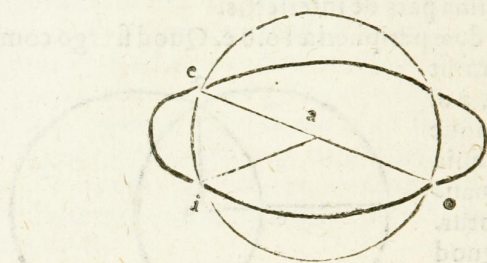


Quare si peripheriæ sint intersectæ aut contiguæ sunt eccentricæ: At (inquis) an non circulo cir-

e 3 culum

culum æqualem imponere possem & homocentricum? an non hic contiguæ peripheriæ homocentricæ? At inquam hic non amplius duo circuli: sed unus est. Nam (ut Vitellio petit) cum plana duo sese contingunt, unum inde efficitur. Et illud est argumentum ἐφαρμόσεως generale, etiā speciale Euclidē ad 4.8.p.1.

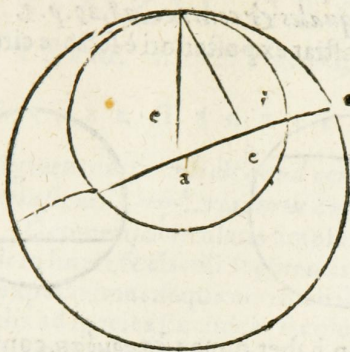
Tertia pars: intersectas duas tantum intersectari duobus punctis duplicem invenit apud Euclidem demonstrationem. At po



teriorē prima parte hujus elementi facilis est ista. Nam si pluribus duob. punctis intersectantur, intersectæ non sunt eccentricæ.

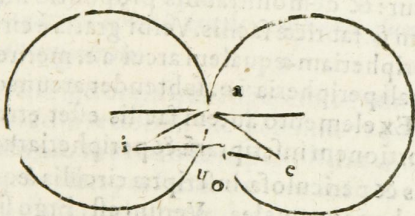
Nam invento centro per 12. e. ductæ rectæ in puncta sectionum tres, quia radii unius peripheriæ, æquantur: sed ducuntur etiam in reliquam peripheriam è puncto intra eam eadem tres æquales. Ergo est ibi reliquæ centrum per 26. e. 1. itaque habent intersectæ hæ commune centrum. At hoc fieri non potest ut jam demonstravimus: Ergo neq; pluribus duobus punctis intersectæ duæ intersectari possunt.

Quarta pars duabus propositionibus ab Euclide proponitur: primò ubi tactus intus est. ut hic sint centra e & a. dico rectam per a & e cadere in contactum u. Demonstratio per impossibile est. Si enim non cadit in contactum: cadat in punctum o. ducatur igitur radius in contactum e u. Hic in triangulo e u a per 7. e. 6. R. u e e a majora sunt quam u a. hoc est quam a o. jam
ablato



ablato communi a e. remanet u e maior quam e o. Sed u e æqua-
tur e i. quia sunt radii ejusdem peripheriæ. Ergo & e i maior est
quam e o pars nempe toto: quod est absurdum. idem erit quo-
cunq; continuatio diametrorum cadere dicatur extra cōtactum.

Si tactus extra sit de
quo est Eucl 12. p. 3. idem
erit. Nam si recta per cen-
tra i & e dicatur alio ca-
dere quam in contactum
cadat sane in u & o. jam
sint radii i u. i a. & e o. e a
utringq; æquales. Sed i a.
e a sunt majores quam i e per 7. e. 6. R.



Ergo & i u. e o sunt majores quam i e. partes nempe toto. Vel
eadem linea i e major erit i u. o e tanquam suis partibus: & ta-
men minor iisdem: quia æquantur a i. a e majoribus recta i e.
Quod utrumq; absurdum est.

Atq; sic obliquas lineas siue peripherias solas habuimus: De
inscriptis autem & peripheriis ratio hæc est;

24. Si

40 G E O M E T R I A E

14. Si inscriptæ circulis æqualibus sunt æquales: secant
peripherias æquales: & contra. 28. 29. p. 3.
Euclides demonstrat ex posteriori è sectore circuli. At res de-



monstratione non habet opus: $\epsilon\varphi\alpha\mu\acute{o}\varsigma$ constat. congruant
enim circuli: tum & inscriptæ & peripheriæ congruent.

Hinc licet

15. In circulis æqualibus peripheria data unius æqua-
lem abscindere alterius.

Hæc in Messanensi Menelai editione à Maurolyco prima effi-
citur: & demonstrabilis propositio fit, quæ est ex 14. e. postula-
tum & fabricæ facilis. Verbi gratia è circulo i o velis abscindere
peripheriam æqualem arcui a e. metire inscriptam a e. illa in æ-
quali peripheria i o. subtender arcum quæsitum.

Ex elemento autem facilis esset error si quis conciperet pro-
portionem inscriptarum & peripheriarum. ψευδογραφία sanè gra-
vis & periculosa. inscriptæ circulis æqualibus æquales secant pe-
riphas æquales. Verum est: Ergo si major inscripta, si minor,
secat maiorem peripheriam, secat minorem. Et id totum verum
est. Ergo inscriptæ peripheriis similiter maiores, similiter mino-
res, siue proportionales sunt. Falsum id est: ut demonstrat Ptole-
mæus. Eum igitur de disproportione peripheriarum & subten-
sarum lib. 1. magnæ constructionis vide ad caput quod interpreti

9. est. Videbis illic quod ratio maioris peripheriæ ad mi-
norem, major sit: quam maioris inscri-
ptæ ad minorem.

TH. FINKII

TH. FINKII GEOMETRIAE ROTVNDI,

LIBER TERTIVS.



Segmentum circuli est quod comprehenditur extrinsecus à peripheria intus à recta.

Geometria circularis simplex posita nobis fuit in lineis & circuli segmentis: lineas hætenus expeditimus: sequitur circuli segmentum, cujus definitio generalis ad species Euclidean facilius distinguendum præmittitur. Rectam intus esse dicimus non quod unica illa saltem debeat esse: aliàs definitio sectori non competeret. potest enim recta esse simplex aut duplex.

2. *Segmentum circuli est sector aut sectia.*

Nomina generis & specierum penè eadem sunt: at definitionibus tamen, ut Euclides fecit, distinguemus.

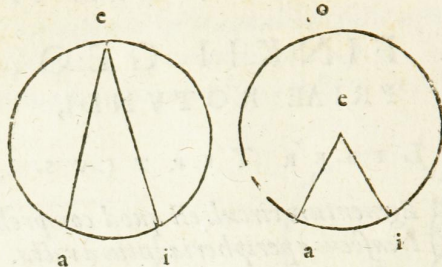
3. *Sector est segmentum circuli intus comprehensum à recta duplici faciente angulum.*

Euclides eum saltem vocat sectorem qui angulum contineat ad centrum: verū nos generatim sectorem hic definimus: quem postea distinguemus ex angulo in centro & in peripheria: quos angulos Euclides retinet: nec semper sectorem vocat sed periphrasi angulum in centro dicit: qui est angulus sectoris in centro. ideo & angulus in peripheria erit angulus sectoris in peripheria.

4. *Basis sectoris est peripheria cui insistit.*

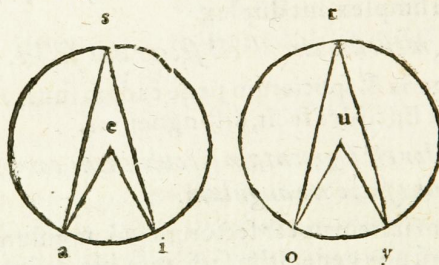
Exempli gratia sit in circulo recta duplex ad centrum a.e.i.e. erit a.e.i. sector: cujus basis est peripheria a.i. Eodem modo si concurrat recta illa duplex in peripheria.

f s. Anguli



5. Anguli sectorum circularum æqualium sunt ut bases: & contra. 33.p.6.26.27.p.3.

Euclidis 33. p. 6. generalis est quod anguli sint ut bases. inde speciales sunt 26. 27. p. 3. de æqualibus angulis & basibus: & quidem utring; de angulis in centro aut periphæria.



Sed de angulis in centro satis est induci. Sint enim æquales anguli in centro $a e i$ & $o u y$. per 2. e. 7. R. bases $a i$ & $o y$ erunt æquales: ideo secant periphærias $a i$ & $o y$ æquales per 14. e. 2. itaq; si anguli sint inæquales periphæriæ etiam tanto erunt inæquales. idem erit de angulis in periphæria. Et conversa similiter patebit. Si enim bases sint æquales, iis subtensæ æquabuntur per 14. e. 2. & tum per 1. e. 7. R. anguli $a e i$ & $o u y$ æquabuntur. & sic de inæqualibus basibus induces. Et sic revera Euclides inducit. Nam posita propositione 6. d. 5. assumptionem de simili excessu aut defectu assumit à nulla præexistente demonstratione.

Itaq;

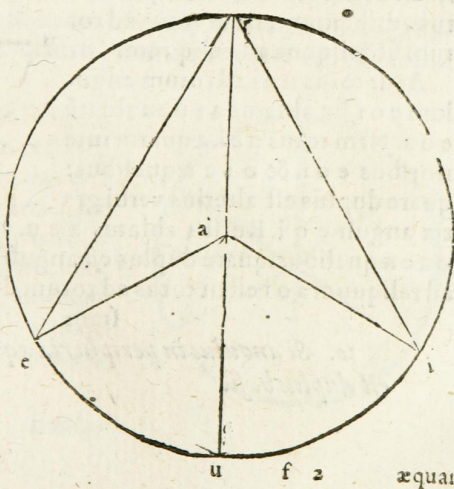
ut arat a mensura, ad
 etiam mensura, ut sector ad sectorē sic angulus ad angulū. ad 33.p.6.
 Sicut se habet a e i ad o u y. sic angulus a e i. ad o u y.
 7. Sector est in peripheria aut centro.
 Euclides habet angulum in centro & peripheria: illum secto-
 ri in centro tribuit: ergo & hic sectori in peripheria tribuetur.
 8. Sector in peripheria est cuius recta facit angulum in
 peripheria: in centro, cuius recta facit angulum in cen-
 tro. 9.d.3.

ut in præmissis figuris a s i. o r y sunt sectores in peripheria:
 a e i & o u y in centro. Sed, inquis, nō omnis sector in centro con-
 tinetur à recta faciente angulū ad centrū ut sector i s e a. segmen-
 tum scilicet reliquum circuli de sectore i e a. Fateor quidem Ar-
 chimedi segmentū hoc dici sectorem majorem: verum nos Eu-
 clidis definitionē retinuimus: & pars ea interjecto radio in duos
 sectores secari potest: ut postea secatur in geodæsia. itaq; mini-
 mum sectores in centro tres sunt.

9. Si sector in centro in eandē basin insistat cū sectore
 in peripheria: angulo suo duplus est anguli sectoris in peri-
 pheria. 20.p.3.

Exempli apud Eu-
 clidem varietas tri-
 plex est. primū cum
 angulorum diversa
 sunt latera ut hic

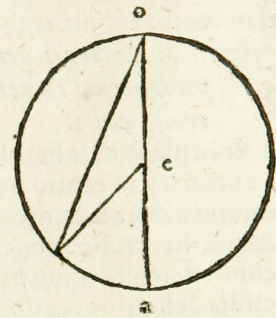
Angulus e o i. &
 e a i. basi cōveniant:
 dico angulum e a i.
 duplum esse anguli
 e o i. ducatur enim
 diameter o u. fient
 utrinq; triacula æ-
 quicrura o a e & o a i.
 itaque per 10. e. 6.R.
 angulus a o e. & e



æquan.

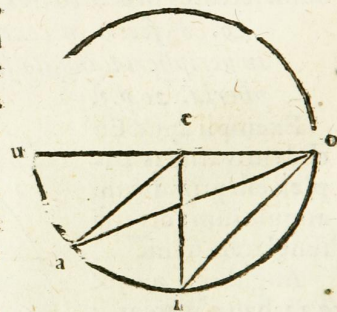
æquantur item anguli $a o i$. & i . jam per 2. c. 9. e. 6. R. angulus $e a u$ æquatur interioribus duobus æqualibus quare anguli $ad o$ duplus est: eodem modo angulus $u a i$ æqualium duorum alterius etiam anguli $a o i$ duplus est. itaq; totus $e a i$. duplus est totus $e o i$.

Secundum exemplum ubi angulorum duo latera ejusdem rectæ nempe diametri sunt. ut in hac figura angulus e duplus est anguli o . ob eandem causam. Nam $o e$. $e i$. æquantur per 2. e. 1. Ergo anguli o . & i æquantur: sed his æquantur angulus $a e i$. Ergo alterius duplus est.



Tertium exemplum est ubi angulus in peripheria non continet angulū in centro. ut in adjuncto schemate.

Sit angulus in centro $a e i$. communis basis cum angulo $a o i$. dico angulum $a e i$ esse duplum $a o i$. Ducatur enim diameter $u e o$. Hinc ita: Si sit ut totus ad totum, sic ablatum ad ablatum: erit ut totus ad totum sic reliquus ad reliquum.



At ut totus $u e i$ ad totum angulum $e o i$, sic ablatum $a e u$ ad ablatum $e o a$. Nam totus $u e i$. æquatur interioribus $e o i$. & $o i e$ æqualibus: quare duplus est alterius verbi gratia anguli $e o i$. Rursus ablatum $a e u$. æquatur angulis $e o a$. & $o a e$ æqualibus. quare duplus est anguli $e o a$. Ergo reliquus $a e i$ ad reliquum $a o i$ est ut totus ad totum duplus.

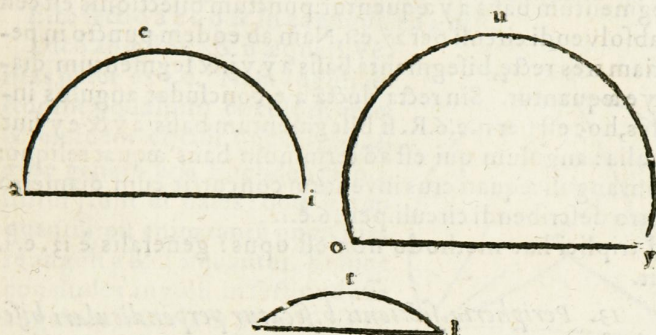
Itaq;

10. Si angulus in peripheria æquetur angulo in centro: est duplus basi.

Veritas

Veritas & ratio confectarii manifesta est: & hinc patet æquatio angularum in centro & peripheria.

11. *Sectio est segmentum circuli intus comprehensum ab una recta, quæ basis sectionis dicitur. 19. d. 1.*
ut hic sectiones sunt.

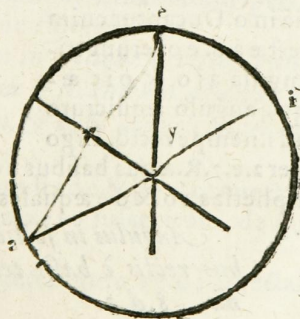


12. *Sectio absolvitur invento centro. 25. p. 3.*

Absolvere circuli sectionem est datæ sectionis circulum describere. id fit invento centro. centri inventio exposita est 12. 13. 27. e. 1.

ut esto sectio aei. absolvenda.

Secetur itaq; basis ai. rectè & bifariam. Nam recta bisecans erit diameter per 12. e. 1. præterea à termino basis a. inscribatur recta a e. quæ etiâ bisecetur rectè: & hæc recta erit diameter. itaq; concursus y erit centrum circuli per 13. e. 1. quo dato & radio noto sectio absolvitur.



f 3 Eucli-

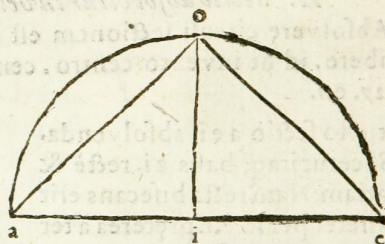
Euclidis fabrica paulo aliter fit. primam diametrum dicta jam ratione ducit. deinde terminum hujus diametri notum, ut exempli gratia hic e connectit cum termino basis a. Quod si jam recta ducta cum dictis terminis claudat angulos æquales, hoc est per 10. e. 6. R. segmentum diametri à puncto bisectionis nempe y e & bisegmentum basis a y æquantur: punctum bisectionis est centrum absolventi circuli per 27. e. 1. Nam ab eodem puncto in peripheriam tres rectæ, bisegmenta basis a y. y. i. & segmentum diametri y e æquantur. Sin recta ducta a e concludat angulos inæquales, hoc est per 11. e. 6. R. si bisegmentum basis a y & e y sint inæqualia: angulum qui est ad terminum basis æquat reliquo: atq; tum anguli æquati crus inventum concurrat cum diametro in centro describendi circuli. per 26. e. 1.

Sed triplici hac methodo non est opus: generalis è 13. e. 1. sufficit.

13. Peripheria sectionis biseclatur perpendiculari biseclante basin. 30. p. 3.

ut sit sectio a o e biseclanda.

Biseclatur igitur basis a e: & ducatur perpendicularis per 7. & 9. e. 5. R. dico à perpendiculari biseclari peripheriā in o. Ducantur enim rectæ a o. e o. erunt triangula a i o & o i e æqua angulo æquicrura ad 1. nempe recto. Ergo per 2. e. 7. R. æqua basibus a o & o e. quæ ideo per 14. e. 2. secant peripherias a o & o e æquales.



Angulus in sectione est angulus comprehensus à duabus rectis è basis terminis sibi in peripheria conterminis. 8. d. 3.

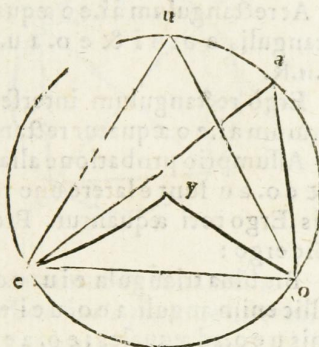
ut in

ut in superiore figura rectæ a o. e o è terminis basis a & e sibi in peripheria ad o conterminis comprehendant angulum in sectione. Sequitur ratio sectionis in angulis. Et primò sectionis unius.

15. *Anguli in eadem sectione sunt æquales.* 21.p.3.

Esto sectio a e u o & in ea anguli ad a & u.

Dico angulos a & u æquari. Veritas patet ex 5.e. Nam anguli sectorum æqualium circularū itaq; & ejusdem circuli (quo ἐφαρμοσως genere etiā Euclides 30.p.3. utitur) sunt ut bases: quæ hic æquantur: est enim tantū una. Quare anguli a & u æquantur. Et hinc concludes angulū in sectione esse angulum sectoris in peripheria: cuius basis à basi sectionis subtrahatur.



Euclides demonstratio hæc est, ex axioma arithmetico: proportionalia ad idem æquantur: At anguli a & u sunt proportionales ad idem nempe dupli ad angulum y in centro per 9.e.

Ergo anguli a & u æquantur. At demonstratio tantum specialis esse angulorum in maiore sectione videtur.

16. *Si duorum angulorum in sectione vertices connectantur: rectangulum crurum se secantium æquatur rectangulis crurum reliquorum, & basis atque connectentis.* 9.c.1. Ptolem.

Esto sint in sectione a e i o. duo anguli ad e & i, qui connectantur recta ei: & ita erit quadrilaterum a e i o inscriptum, de quo Ptolemæus loquitur.

Dico rectangulum a i e o æquari rectangulo a e o i & rectangulo a o e i.

Ponatur

Ponatur enim per 5. c. 6. e. 3. R. aut absoluta sectione per 5. e. angulo o ei æqualis a e u.

jam Syllogismus demonstrationis hic esto.

Rectangula e o. u i & e o. a u æquantur rectangulis a o. e i. & a e. o i.

At rectangulum a i. e o æquatur rectangulis e o. u i & e o. a u. per 4. e. 11. R.

Ergò rectangulum intersectorum crurum a i. e o æquatur rectangulis a o. e i. & a e. o i.

Assumptio probatione alia non eget. Nam rectangula e o. u i & e o. a u sunt è latere uno rectanguli a i. e o & reliqui segmentis. Ergo toti æquantur. Propositio igitur demonstranda erit: Sic ergo:

✓ Bis bina triacula e i u. e o a. & a e u. o e i sunt æquiangula. illic enim anguli a e o. u e i ex additione æqualis sive communis u e o. ad æquales i e o. a e u ex thesi, æquantur: Anguli vero e i u. & e o a per 15. e. æquantur: reliqui ad u & a per c. 3. e. 7. R. erunt æquales.

Hic vero anguli a e u. o e i ex fabrica, ad a & o ex 15. e. reliqui ad u & i per c. 3. e. 7. R. æquantur.

Itaque figillatim bina cruribus sunt proportionalia per 9. e. 7. R. Eritq; illic

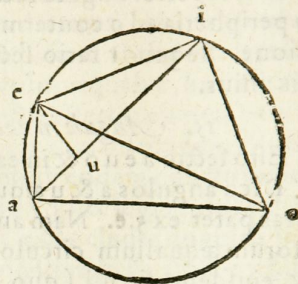
ut a o ad u i sic e o ad e i.

Hic vero & alternè

ut a e ad a u sic e o ad o i.

Itaq; per 5. e. 11. R. illic rectangulum u i. e o rectangulo a o. e i. hic vero rectangulum a u. e o rectangulo a e. o i æquabitur. Atq; ita syllogismi constat propositio. & elementi veritas.

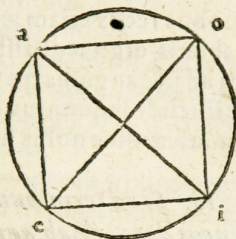
Habuius itaq; considerationem solius sectionis: plurium ratio itidem in angulis jam sequitur.



17. *Anguli in oppositis sectionibus æquantur duobus rectis.* 22.p.3.

Euclides hic, ut in præmissis elemento Ptolemæus, in scripti quadrilateri meminit. At aptius elementum proponetur ab oppositis sectionibus resectis nempe inscripta: nihil enim adhuc de inscriptione fuit.

Sint ergo oppositæ sectiones oie & oae. dico angulos in sectionibus oae & oie æquari duobus rectis. Nam æquantur tribus trianguli eoi. Etenim angulus i primo sibi ipsi æquatur. deinde eao. æquatur angulis oei. & eoi suis nempe partibus. quia oai æquatur angulo oei. & eai æquatur angulo eoi per 15.e.



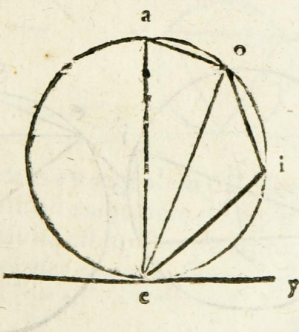
At trianguli tres anguli per 9.e. 6.R. æquantur duobus rectis.

18. *Anguli in oppositis sectionibus æquantur alternis angulis secantis & contigua.* 32.p.3.

Euclides & cum eo alii nonnulli elementum hoc doctrinæ cuiusdam sectionis nempe semicirculi postponunt. At ego memor quos mihi in syntaxi hac cancellos circumdederim, quod sectionis erat in genere, præmittere volui.

Sint ergo oppositæ sectiones eio. & eao tangens vero uey.

Dico angulum oae equari angulo oey. & angulum oie æquari angulo oeu. Quod si e a non sit diameter, fiat sane diameter ob demonstrationem. manebit enim angulorum in sectione æqualitas per 15.e. jam quod ad primam æquationem attinet tres anguli



g aeu.

a e u. a e o. o e y æquantur duobus rectis per 1. c. 8. e. 5. R. At duobus rectis æquantur etiam anguli e a o. a o e. a e o. per 9. e. 6. R. jam ab æqualibus his auferantur primo communis a e o deinde recti (qui etiam æquales sunt) a e u. ex thesi, quia u e y tangens est, & a o e rectus per 15. e. 1. & 8. e. 3. R. relinquuntur ergo æquales e a o. o e y. Deinde quod ad alteram æquationem: anguli ad a & i æquantur duobus rectis per 17. e.

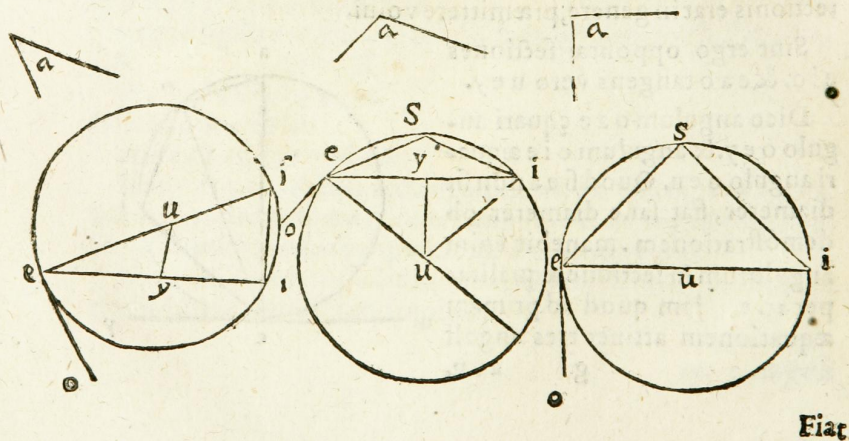
At duobus rectis etiam æquantur anguli o e u. o e y per 1. c. 8. e. 5. R. ablatis ergo æqualibus angulo a & o e y relinquuntur æquales ad i. & angulus o e u.

Hinc Euclidi sequuntur duæ propositiones mechanicæ sive problematicæ: quæ nobis hinc sunt confectaria specialia.

Itaq;

19. Si ad terminum data rectæ æquetur angulus rectilineus dato, & ab æquati vertice perpendicularis reliquo lateri concurrat cum perpendiculari à medio data: concurrus erit centrum circuli per æquatum angulum descripti, in cuius opposita sectione super datam angulus æquabitur dato. e 33. p. 3.

Esto recta e i & datus angulus a. jam sit describendus circulus per angulum dato æqualem ut super rectam constituatur angulus dato æqualis in sectione: quod Euclides proposuit.



Fiat itaq; ad terminum e angulus o e y æqualis dato: & à ver-
tice e item medio datæ rectæ y concurrant duæ perpendiculares
e u. y u in u. Dico ibi esse centrum circuli per verticem æquati
anguli describendi: atque angulum in opposita sectione e u i.
nempe e s i æquari dato. itaq; si angulus datus rectus sit data, re-
cta est diameter circuli optati: & proinde centrum datur. in acu-
to angulo & obtuso demonstrabitur simul.

Concursus diametrorum habet centrum.

At concursus dictarum perpendicularium est concursus dia-
metrorum. Nam perpendicularis à vertice anguli est diameter
per 2. e. 2. item perpendicularis à medio basis per 12. e. 1. Ergo con-
cursus perpendicularium erit centrum.

De angulo in sectione simili argumento in triplici angulorum
genere concludes. Nam angulus in sectione opposita æquatur
angulo o e y per 18. e. At angulus o e y æquatur dato. Quare hinc
licet super datam rectam sectionem describere, quæ capiat an-
gulum rectilineum æqualem dato.

Et

20. Si angulus secantis & contiguae æquetur dato angu-
lo rectilineo: angulus in opposita sectione eidem pariter
æquabitur. 34. p. 3.

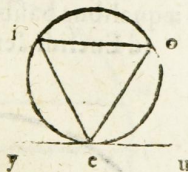
Euclides proponit à dato circulo secare sectionem quæ angu-
lum contineat æqualem dato angulo rectilineo.

Fabrica itaq; huius in di-
cto elemento exposita est.

Sit datus angulus a. & cir-
culus e i o. Secanda jam sit
optata sectio. Ducat itaq;
ad punctum e tangens y e u.

jam è puncto e recta faciens angulum o e u æqualem dato secat
sectionem e i o quæ contineat angulum o i e æqualem o e u: per 18
e. hoc est angulo dato. Ratio sectionis ita est: similitudo sequitur

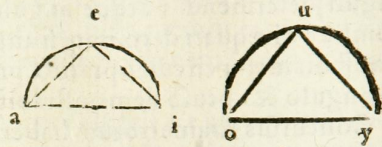
21. Si sectiones capiunt angulos æquales: sunt similes.
è. 10. d. 3.



Euclides definitionem hinc 10. fecit vel 11. ut Cómandini fert exemplar. Sed non tam definitio est quam è definitione generali similium figurarum consecrarium.

ut hic a e i. o u y.

Hinc peripheriarum & basiū consequitur proportio, ut Pappus ait 13. the. 5. lib. Et triacula inscripta quia sunt æquiangulara ex thesi, erunt etiam similia. per 9. e. 7. R.

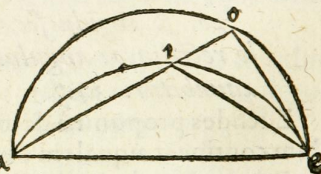


22. Si sectiones similes sunt in æquali basi: sunt æquales. 23. 24. p. 3.

Euclides hinc fecit duas propositiones: diligentius tamen examinatæ in idem recidunt. Nam prior negans in affirmatam mutata idem enunciat quod sequens affirmata. Demonstratio est per absurdū. Nam si nō sunt æquales in æquali sive eadē basi:

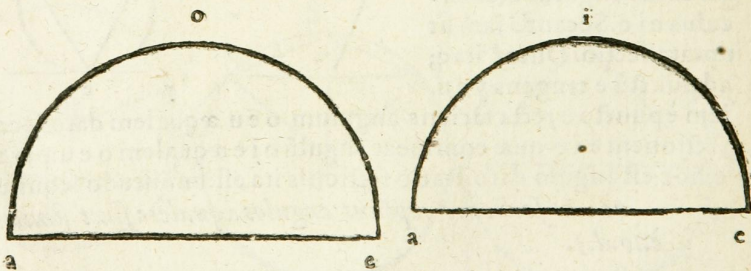
Sint inæquales ut sectio a i e & a o e.

Itaque anguli a i e. a o e per 21. e. sunt æquales. At per 4. c. 9. e. 6. R. angulus a i e est major angulo a o e. Quare nō possunt esse sectiones inæquales si similes sint in eadē basi.



Rursus sint sectiones similes in æqualibus basibus a o e & a i e. Dico esse æquales.

Id Euclidi demonstratur per ἰσότητος: & absurdum.



Nam

Nam a e sibi congruunt. Sectio autem sectioni etiam congruet. Secus intus cadet aut extra, aut partim extra partim intra.

At hoc est contra primam partem. quia sectiones similes in eadem basi (qualis hic per $\epsilon\phi\alpha\rho\mu\delta\sigma\iota\psi$ est) non essent aequales. praeterea circulus circulum secaret in pluribus punctis quam duobus: nempe in terminis basis & loco aliquo in peripheria ubi cadit extra: at hoc fieri nequit per 13. e. 2.

23. *Angulus sectionis est qui comprehenditur à terminis sectionis.* 7. d. 3.

Sic in praemissis schematis angulus o a e. & o e a sectionis angulus dicitur: comprehensus scilicet à peripheria & basi.

TH. FINKII GEOMETRIAE ROTVNDI,
LIBER QVARTVS.

De cruribus anguli in semicirculo.



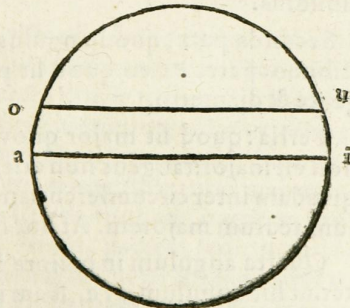
Sectio est semicirculus aut inaequalis semicirculo.

2. *Semicirculus est sectio dimidia circuli.*

Itaq;

3. *Semicirculus comprehenditur à peripheria & diametro.* 18. d. 1.

Sic a y i vel a e i est semicirculus. nempe dimidia sectio circuli. comprehenditur autem à diametro & peripheria: quia circulus non nisi diametro bifecatur. o y u est maior sectio. o e u est minor sectio.

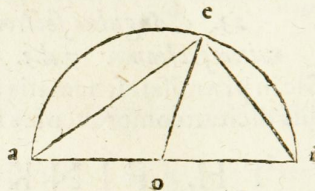


8 3

4. *Angulus*

4. *Angulus in semicirculo rectus est, semicirculi minor recto rectilineo, major quovis acuto: in maiore sectione est minor recto, maioris major: in minore major, minoris minor.* è 31. 16. p. 3.

Elementi partes sunt septem. prima angulum in semicirculo esse rectum, ut hic angulum $a e i$: patet per 15. e. 1. Nam $a e i$ è diametri terminis sibi conterminantur in peripheria. Ergo per 15. e. 1. sunt inter se rectæ: & proinde per 8. e. 3. R. angulus $a e i$ est rectus.



Poterit & hoc modo demonstrari dimisso radio $e o$, quia $a o$ & $o e$ æquantur: anguli $a o e$ & $o e a$ æquantur per 10. e. 6. R. eodemque modo $o e i$ & $o i e$. Quare totus $a e i$ æquatur duobus $e a i$ & $e i a$. At si angulus trianguli æquatur reliquis rectus est per 1. c. 3. e. 8. R.

Aristoteles hanc Geometriam in organo logico & philosophia comprehendens angulum in semicirculo rectum dicit: propterea quod sit dimidius duorum rectorum: nempe angulus $a e i$ est rectus, quia est dimidius duorum ad o qui æquatur duobus rectis, vel si $a e$ cõtinuetur: sunt recti duo: ergo unus eorum dimidius.

Secunda pars, quod angulus semicirculi sit minor recto rectilineo: patet ex eo quod sit pars recti rectilinei: qui sit è tangente & diametro.

Tertia: quod sit major quovis acuto patet per 4. e. 2. secus si non est major: tangens non erit singularis eadẽ parte: sed caderet quædam inter circumferentiam & tangentem quæ faciat angulum acutum majorem. At hoc fieri nequit.

Quarta angulum in maiore sectione esse minorem recto patet, ut hic angulum $a i e$. Nam in triangulo saltem potest esse rectus

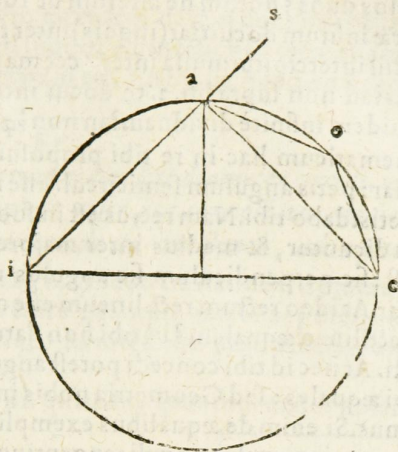
ctus unus. Quare cū e a i.
tanquam in semicirculo
sit rectus. a i e erit recto
minor. Et si crus neutrum
sit per centrum: constitui
tamen potest angulus, cu
jus crus sit diameter: an
gulus tamē equalis, nem
pe in eadem sectione.

Quinta, angulum ma
joris sectionis i a e esse
majore recto patet, quia
rectum rectilineum con
tinet qui est ad a in trian
gulo i a e.

Sexta sic patet: angu
lus in minore sectione e o a est major recto: quia cum angulo
in opposita majori sectione a i e æquatur duobus rectis per 17. e.
At angulus a i e est minor uno recto. Quare angulus e o a est ma
jor recto.

Septima: angulus minoris sectionis o a e est minor recto: quia
est recti pars. quemadmodum patet si protrahatur latus a i. fiet
angulus exterior e a s rectus per 15. e. 1. & 8. e. 5. R. & hic angulum
minoris sectionis continet.

Atq; hæc Geometria est angulorum sectionum circularium,
ubi singularis & mirifica patet peripheriæ natura. Datur in cir
culo major recto: datur minor recto illic in majori hic in minori
sectione. Ecquid igitur negabis (inquiunt qui semicirculi an
gulum rectilineo recto æqualem volunt) in æquali sectione quæ
est inter majorem & minorem etiam angulum inter majorem &
minorem nempe rectum dari. Cur ni, inquam, negarem? an tu
contentum continenti æquale facies, partem scilicet toti? an
non rectum rectilineum esse didicisti diametri & tangentis? rur
sus an non inter diametrum & tangentem peripheria secat an
gulos



gulos duos? horum ne alterum ut toti parem facias lumen naturæ insitum docuit? at (inquis) inter tangentem & peripheriam nihil intercipitur: nulla interjacet magnitudo. Cur id non probas? an non supra lib. 2. te docui interjacere magnitudinem & quidem infinitè dividuam? an non ἐφαρµοσιν documentum mathematicum hac in re tibi proposui? Sed vide quid tibi largiar: petis angulum semicirculi esse rectum: quod si nihil aliud petis: dabo tibi. Nam rectus est in suo genere: & sic recti in sphaera dicuntur, & medius inter majorem & minorem sui generis est: sic perpendicularum sic angulus rectus generatim definiuntur. At ideo rectum rectum lineum esse contendis? aut recto saltem rectilineo æqualem? id tibi non datur: cur non detur intellexisti. At nec id tibi concedi potest angulos semicirculorum esse sibi æquales: sed Geometria nobis imperat ut inæquales statuamus. Si enim de æqualibus exempli gratia rectis recticuris tollantur inæquales anguli tangentium & peripheriarum inæqualium, relinquuntur anguli semicirculorum inæquales. At (inquis) quis tibi dedit angulos illos cōtactuum in peripheriis inæqualibus esse inæquales: id, inquam, ἐφαρµοσιν Geometrica 6. e. 2. me docuit.

Videatur itaq; sane res mira: dari majus, dari minus, & dari id inter quod æquale: æquale tamen non dari: vera tamen interim habeatur: verum, inquam, statuamus rectum rectilineum angulo semicirculi majorem. Sic mira est res in ratione inscriptarum dari rationem æqualitatis, rationem inæqualitatis utriusq;: non tamen dari proportionem. interim veram tamen Ptolemæus convincit.

Sed ad opes anguli nostri in semicirculo revertamur: quæque inde oriantur videamus.

Itaq;

5. Si duæ rectæ diametro circuli conterminæ conterminentur in peripheria: comprehendunt angulum rectum.

Fiēt enim angulus in semicirculo: & angulus in semicirculo rectus est. Hinc Vogelinus 2. p. 2. sui elementalis quærit centrum

trum circuli. Nam inscribit in circulum datum duas inscriptas inter se rectas: quæ crura recti sunt: ea connectit basi recti: quæ est diameter: in cuius medio centrum est. Atq; sic quartam habemus centri inventionem.

Et

6. Si duarum rectarum maior fiat diameter circuli, minorq; majori contermina & inscripta connectatur: major plus poterit quam minor quadrato connectentis. ad 13. p. 10.

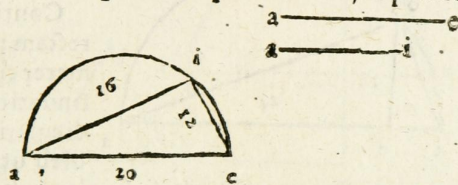
Lemma duplex assumitur ad 14. p. 10. in translatione Commendini: datis duabis rectis invenire quantum major sit potentior minore: & quæ possit utramq;. At intellecto primo secundum ex 5. e. non erit obscurum.

Esto sint duæ rectæ a e & a i. quæritur quantum major possit plus quam minor. Respondetur hoc elemento. Fiat itaq; major a e diameter circuli: & à termino diametri inscribatur a i. connectaturq; cū reliquo diametri termino e. dico a e plus posse quam a i potentia e i. Nam triangulum a i e sit rectangulum per 4. e. Ergo per 5. e. 12. R. basis a e æque potest cruribus: proindeq; plus potest quam a i quadrato e i. Atq; hinc licet trium ejusmodi rectarum datis duabus tertiam invenire. Et sic Ptolemæus 9. c. 1. data diametro & inscripta, reliqui arcus ad semiperipheriam chordam investigat. Exempli gratia si a e major esset 20. a i vero 16. potentia a e est 400. potentia vero a i est 256. Ergo potentia e i est 144. ejusq; latus nempe recta e i erit 12.

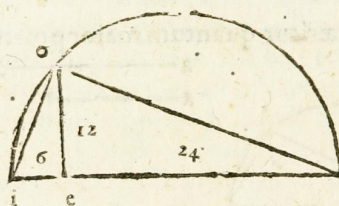
Et

7. Si recta continuata à duabus rectis fiat diameter circuli: perpendicularis à puncto continuationis in peripheriam erit proportionalis inter datas. 13. p. 6.

h Ex



Ex iis quæstionibus quæ Mathematicos veteres valde exercuerunt: non postrema fuit ea quæ de cubi est duplicatione. Eam ad rem tandem ab Hippocrate Chio è mercatore Mathematico Mesolabium inventum tota posteritas approbavit. At Mesolabium illud inventio erat duarum mediarum continuè proportionalium: cuius usus ad quælibet corpora optata similia fabricanda postea traductus est. Quare & ratio inventa est describendi & fabricandi superficies similes: & id quidem per unam mediam: cuius fabrica etiam Mesolabium dici posset aut Mesographus. Fabrica autem è thesauris anguli in semicirculo depromitur. Sint enim duæ rectæ a e & e i. quibus invenienda sit media proportionalis.



a ————— e
e — i

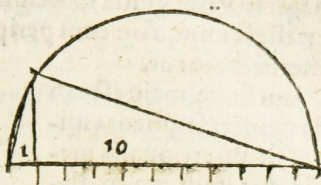
Continuentur itaq; in unam rectam: è cōtinuata a i fiat diameter circuli i o a. è puncto continuationis e erigatur perpendicularis e o. in peripheriam: dico ut a e est ad e o. sic esse e o

ad e i. Nam perpendicularis in triangulo ab angulo recto in basin est proportionalis inter segmenta basis i. c. 4. e. 8. R. At e o est perpendicularis in triangulo ab angulo recto, quia semicirculi, in basin.

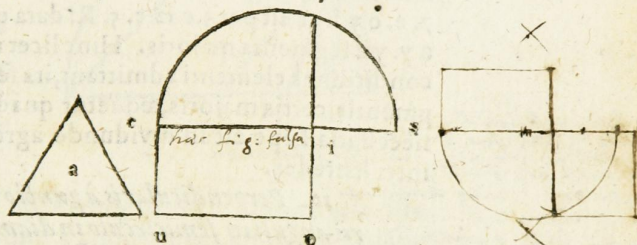
Hinc trium harum rectarum datis duabus in numeris tertia inveniatur ex doctrina continuæ proportionis & inventionis lateris quadrati. ut si verbi gratia a e esset 24. & e i esset 6. erit e o 12. Nam 24 per 6 facit 144. cuius latus est 12. Sic si detur i e 6. & e o 12. jam multiplica 12 per se, factum 144. diuide in 6. quotus 24 est longitudo a e. Itaq; hinc licet

Ratio talis è. *Rectilineum 8. Rectilineo constituere aequale quadratum. 14. p. 2.*
si no fuerit oblongum Nam datum rectilineum aut oblongum est aut triangulum &
reducatur ad oblongum alias triangulatum. Si oblongi latera continuata fiant diameter:
p. 1. & 2. qd. 10. e. 10. è puncto item erigatur perpendicularis: ea erit proportionalis
R. 2. inter continui inter
na oblongi latera perpendicularis
invenietur. Invenit itum a
quod data figura rectilinea.

inter latera oblongi, itaq; per 4. e.
12. R. latus quadrati æqualis dato
oblongo, ut si sit oblongum decem-
pedale: cujus latera sint pedum 10.
& 1. tum latus pedum 10 continue-
tur cum latere pedis unius: propor-
tionalis media erit latus, ut in ad-
iuncta figura.



Si rectilineum præter oblongum detur aliud: oblongo æqua-
ri necesse est per 1. & 2. c. 10. e. 10. R. Tum oblongo æquato æqua-
le quadratum, dato rectilineo æquabitur, ut si triangulo a. velis
constituere quadratū æ-
quale, per 1. c. 10. e. 10. R.
fiat oblongum e i o u æ-
quale dato triangulo.
jam latera e i i o fiant dia-
meter, erit y latus qua-
drati quæsitū.

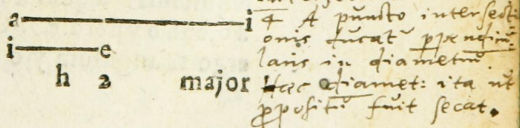


Campanus addit ra-
tionem secandi datarum
majorē ut inter segmen-
ta minor sit proportionalis: at fabrica est specialis. nam quanti-
tas minoris determinatur ne scilicet major sit quam dimidia ma-
joris. Fabrica sic est.

Et

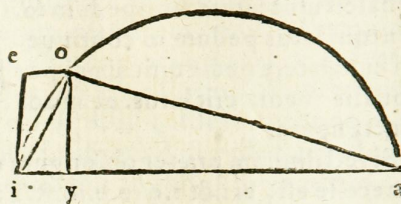
9. Si duarum rectarum major minimum duplia minoris
ris fiat diameter circuli, minorq; extrema diametro perpen-
dicularis connectatur cum peripheria per rectam diame-
tro parallelam: recta à connexionē in diametrum perpen-
dicularis secat segmenta quibus proportionaliter minor
interiacet.

Esto recta major a i minor i e quæ
summum dimidia sit majoris. Nam si



major sit verbi gratia subsequaltera ab ejus termino diametro parallela nunquam cum peripheria concurret: cum radio peripheriæ major sit.

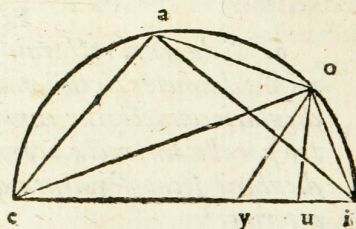
jam sit ita major secunda ut inter segmenta minor sit proportionalis media. fiat itaq; major diameter, atq; termino ejus i. minor erigatur perpendicularis, atq; terminus



e connectatur cum peripheria per rectam e o diametro parallelam. tum à termino connexionis o. sit perpendicularis. jam per 7. e. o y hoc est per 5. c. 12. e. 5. R. data e i est proportionalis inter a y. y i. segmenta majoris. Hinc licet rectangulum, cujus latera conditiones elementi admittant, ita secare ut rectangulum è segmentis certis majoris, æquetur quadrato minoris. Quæ res necessaria sæpe est in dividendo agro rectangulo aut simili re inter hæredes.

Docet hoc. confectum e
nota base & unum quo
base & unum quo
inter basim & unum quo
E data basi & unum quo
in semicirculo & unum quo
dimidii & unum quo
reliq. m. is. 1. Peripheria
subtendens m. is. notum
bifecet. 2. a punto b.
bisectiois perpendicularis
in diametrum ca-
metri a termino i.
lig. inq. ad ppendim
tare & unum quo
fita & unum quo

10. Perpendicularis à punto bisectionis peripheria cruris anguli in semicirculo in diametrum, secat segmentum dimidium differentie reliqui cruris & diametri. g. c. 1. Ptol. Est angulus in semicirculo e a i. atq; à punto bisectionis peripheriæ a i descendat perpendicularis o u. d. segmentum diametri u i esse dimidium differentie reliqui cruris e a hoc e y & diametri, hoc est esse dimidium recta y i.



Ducantur enim a o, o i, o y, o e. jam quia in triangulis a e o, o e y. anguli ad e æquales sunt ex thesi & 5. e. 3. & æquicruri: æquabitur basis a o, basi o y per 2. e. 7. R. sed a o ex thesi & 14. e. 2. æquatur recta o i. ergo triangulum y o i æquicrurum est in basi: & proinde per 2. e. 7. R.

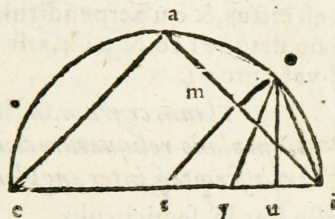
2.e.7.R. perpendicularis o u bifecat basin y i. Quod si jam ei sit
20. ai vero 16. erit a e 12. & proinde u i 4.

Itaq;

11. Si radius bifecat crus anguli in semicirculo: segmen-
tum radii inter centrum & crus dictum est dimidium res-
liqui cruris. 4.th.1. Copern.

Esto rursus in semicirculo angulus e a i. atq; crus a i bifecetur
à radio s o in m. dico segmentum s m esse dimidium ipsius a e.
ponatur enim e y æqualis
rectæ e a. jam hæc sit de-
monstratio. Recta u s est
dimidia rectæ a e.

Nam ea æquatur rectis
e s, s y ex thesi, hoc est i s,
s y. atqui y u, i u æquantur.
quare addito cõmuni s y.
erit s u item s y cum i u se-
missis i s & s y hoc est a e.



At s m æquatur ipsi s u. Nam triangula o s u, i s m cum rectis
habeant ad u & m & angulum s communem erunt æquiangu-
la: & per 9.e.7.R. cū si æquetur ipsi s o & s u æquabitur ipsi s m.

Ergo s m est dimidia rectæ e a.

Copernicus facilius sic demonstrat. Quia duo triangula a e i,
s m i sunt æquiangula. anguli enim a & m recti sunt illic quia in
semicirculo hic ex thesi. & angulus i cõmunis. Ergo ut a i dupla
est ipsius m i sic & a e dupla est rectæ s m.

Ad 6.e. proposita fuit ratio inveniendæ inscriptæ peripheriæ
reliquæ ad semiperipheriam data diametro & inscripta: idem hinc
possumus præstare. Nam datur s i radius & m i dimidia inscri-
pta. Ergo per 5.e.12.R. Dabitur s m. atq; hujus duplum latus a e.
atq; hic calculus est facilior: quanto facilius pauciores numeros
quam plures numeramus. ut si exemplum ejus loci repetatur sit
diameter 20 erit radius 10. inscripta a i 16. erit m i 8. jam potentia
radii minus potetia m i erit 36 cujus latus est 6. nempe s m. ergo
erit e a 12.

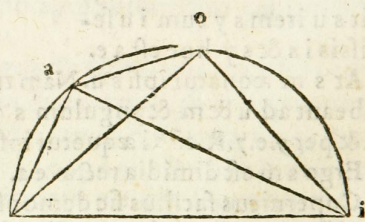
h 3 Et

63

Et licet in numeris

Inventio autem est è proportionē continua, docente propor-
tionem 2, c. 4. e. 8. R. Quia enim in præmisso schemate angulus
e o i est rectus, & o u perpendicularis: erit ur ei ad o i. sic o i ad
u i. jam detur ei 20. & u i 4. erit inde factus 80. cujus latus erit
 $8\frac{1}{4}\frac{6}{7}$ vel 9 pro o i.

Inventio huius est: $\frac{1}{2}$ 20. inscripta o i 12. & a i 16. quæritur inscripta a o. per 6. e. aut 11. e. inveniatur e o 16. a e 12. Hinc planus e o, a i est 256. planus e a, o i est 144. jam minore de maiore ablato relinquitur planus e i, a o 112. Eo igitur diviso in e i 20. quotus $5\frac{1}{2}$ est pro inscripta a o. Es



E

TH. FINKII GEOMETRIAE ROTVNDI,

LIBER QUINTVS.

De semicirculi sinibus, tangentibus,
secantibus.

IN semicirculo considerantur sinus & his connexa recta.
insimilis uerum et subfensu
ue chorda.

Paulatim jam accedimus propius ad subtilissimam mensuram, quæ vulgo per sinus fieri dicitur aut subtensas. Eam nos ex semicirculo deducere volumus: quia in eo primò residet non tam doctrina sinuum quam his connexarum rectarum: quæ mensuram illam tandem perficient.

2. Sinus est recta à termino peripheriæ perpendicularis.

Sinus vocabulum in hac significatione est Arabicum: & ideo barbarum: attamen multorum seculorum consensu in arte retentum fuit. Est enim gratissima in Mathematicis concinna orationis breuitas. Et Aristoteles topico & capite 2. res nominibus tritis & usitatis appellandas censet. Neque commodum magis aut magis Latinum vocabulum habemus. Nam quod quidam Ptolemæum imitati semissem subtensæ dicunt: id, præterquam quod periphrasticum ac longum sit, parum accuratè dici videtur. non enim omni sinui hæc tribui potest appellatio.

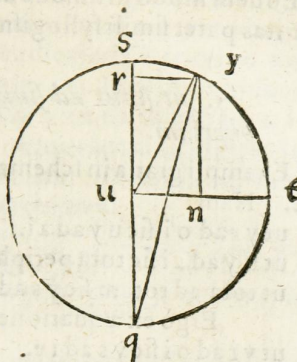
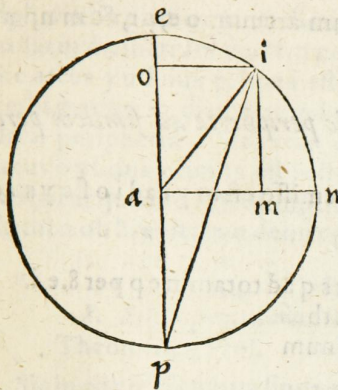
*Similes peripheriæ sunt bases
 semper æquales angulos hæc
 gentia p. 21 e. 3)*

*similes peripheriæ
 bases semper æquales*

3. Similium peripheriarum sinus radiis suorum circulo-
 rum sunt directè proportionales.

Sint enim similes arcus e. i. s. y eorumq; sinus i o, y r, & o e, r s.
 Erit ut u y ad a i hoc est u s ad a e radius nempe ad radium sic
 y radio item r s ad o e.

Prima



Prima pars patet ex 9.e.7.R. Sunt enim triangu-
la yru & ioa æquiangula: cum anguli ad r & o per 2.e. recti, sint æquales per
c.8.e.3.R. & anguli ad a & u sunt æquales. Nam ductis ip & yq
anguli ad p & q æquantur ex thesi & 21.e.3. sed horum equalium
dupli sunt anguli ad a & u . Ergo æquales. Et per c.3.e.7.R. anguli
ad i & y æquantur. Quare dicta triangu-
la cruribus sunt propor-
tionalia.

Secunda pars similiter constat ex axioma illo arithmetico:
si sit ut totus ad totum sic ablati ad ablatum: erit ut totus ad to-
tum sic reliquus ad reliquum.

Hic autem est ut totus su ad totum ea sic ablati ur ad abla-
tum ao . Ergo ut us ad a sic reliquus rs ad reliquum oe .

Itaq;

4. Peripheriarum similium sinus sunt directè propor-
tionales.

Sint in præmissis figuris arcus in , yt item ei , sy similes eo-
rumq; sinus im . hoc est per 6.e.10.R. oa & yn hoc est ru item io
& yr . Erit ut oa ad ru sic oi ad yr . Nam

ut oa ad ru sic ia ad yu .

ut ia ad yu sic io ad ry . Ergo ex æquatione rationum, ut oa
ad ru sic io ad ry .

i Eodem

Prima pars qd ut
oi, ry sing sunt ppor-
tionales, radiis ai ay.
Nam triang: æquang:
la sunt pportional: om-
nib; equalia anguloz
9.e.7. triang: a io, uy
æquangula p
3.e.7.R. Nam o d
æ anguli æquant, qd
interz recto e & oa i
euy æquales ff ex the-
si. eo triang: a io, uy
r: ff pportionalia m
ubg.

Dem: p 9.e.7.R.
e facilior Nam oai
r uy sunt triang:
la æquangula.

Eodem modo in sinibus dictorum arcuum oe , sr , & mn , ne veritas patet simili syllogismo.

Et

s. ut sinus ad sinum, sic peripheria ad similem peripheriam.

Exempli gratia in schemate præmissio est ut y radio sic ys ad ie . Nam

ut y radio sic uy ad ai .

ut uy ad ai sic tota peripheria ts q ad totam ne per 8. e. i.

ut tota ad totam sic ys ad ie ex thesi.

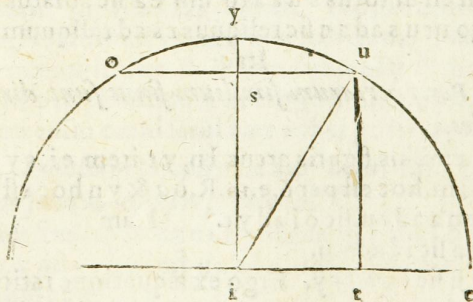
Ergo ex æquatione rationum

ut y radio sic ys ad ie .

6. Sinus primus est aut secundus. *Dis. Sin.*

Sinum recentiores penè omnes secant in rectum ac versum: rectum demum in primum aut secundum. At distributio illa parum videtur logica. Nam & sinus versus est perpendicularis & rectus: jam vero philosopho in topicis distributio ea vitiosa est, ubi partes convenient.

Sinus primus est sinus in diametrum per reliquum
alias sinus rectus, vel semisus. Sinus primus est sinus in diametrum per reliquum
subtense dupli arcus, e. p. per arcus terminum ductam.
Similis, in diamet: a
reliquis dati arcu termi. Sinus generatim fuit definitus perpendicularis à termino pe-
no ducta. p. g. e. invenit similis arcus



ripheriæ

ripheriæ: in primo autem dimittitur eousq; perpendicularis, ut
cadat in diametrum ductam per alterum terminum peripheriæ.
Sic arcus y u sinus primus est perpendicularis à termino uno
verbi gratia u in diametrum i y ductam per alterum terminum
datæ peripheriæ. Sic arcus u e sinus primus est recta u t. ita
arcus o y sinus primus est recta o s. Arque hic sinus semper in-
telligitur quando sinus simpliciter vocatur: Et nos hanc synec-
dochen ob brevitatem deinceps retinebimus.

*Per hoc ol. invenitur sing arcus majoris quadrante
te vel 90. Nam dato arcus quadrante maior
Itaq; subtrahit a semicirculo 180, reliq sing in tabu
8. Sinus peripheriæ est sinus reliquæ ad semiperipheriam. la finem qrat, is e
Theon. u. c. u. Ptol. Epiphanius quodq sing arcus ppe
sit.*

Sic in præmissa figura sinus arcus u e nempe u t est etiam sinus
arcus u y a reliqui ad semiperipheriam. patet ex definitione si-
nus. Nam ut est perpendicularis ab uno termino in diametrum
per reliquum terminum ductam.

Atq; hinc est quod vulgo dicunt eundem sinum esse duorum
arcuum: unius quidem quadrantis peripheriæ minoris, alterius
vero majoris. Quæ res in calculo sæpe imperitis imponitur: ut an-
gulum inveniant acutum ubi obtusus est. Sinus quadrantis peripheriæ e recto sine

9. Radius æquè potest sinibus peripheriæ & comple-
menti. i. p. Regio de sinib.

Sequitur deinceps comparatio sinuum cum radio & inscri-
ptis: & primo ratio æqualitatis in potentia sinuum & radii com-
paratione. Complementum dati arcus vocatur ipsius & periphe-
riæ quadrantis differentia. Exempli gratia, arcus y u est comple-
mentum arcus u e, item arcus u a. quia est differentia y e & di-
storum arcuum. Sit jam sinus arcus u e recta u t. & complementi
u y sinus sit recta u s. Dico radium i u æquè posse sinibus u s,
u t. per 5. e. 12. R. Nam triangulum u s i est rectangulum.
Ergo i u æquè. potest cruribus u s & s i hoc est, per 2. c. 6. e. 10.
R. u t. Hinc jam dato radio cum sinu peripheriæ datur sinus

i 2 con.

complementi. ut si detur ut 8. & radius sit 10. erit potentia radii 100. potentia vero ut 64. Ergo hac ab illa subducta potentia u s relinquetur 36. cuius latus 6. est ipse sinus u s.

Sinus complementi vulgò dicitur sinus rectus secundus arcus cuius est complementum. verum & intelligenter magis dicitur complementi sinus: & in bonis authoribus sinus complementi dicitur. Sequitur ratio inæqualitatis cum inscriptis.

*Ptolemaeus & Copernicus solum in radiis
inscriptis integris & non in sinibus. 10. Sinus est dimidiatus inscripta arcus dupli.*

ut in hac figura u s
est dimidiatus o u sub-
tendentis peripheriã
u y o. duplam peri-
pheriã u y cuius si-
nus est recta u s. Nam
radius i y recte secat
inscripta o u per 7. e.
Ergo per 19. e. i. bise-
cat. est itaq; u s dimi-
dius ipsius o u. sed & arcus o y u est duplex arcus y u. quia bise-
catur in y per 13. e. 3.

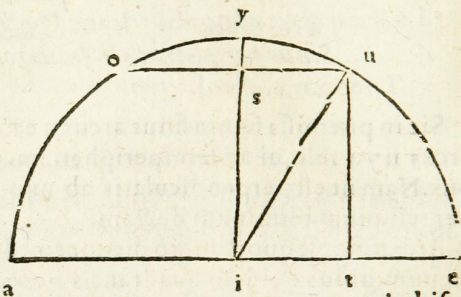
Ex hoc elemento vulgo definiunt sinum chordam (sic appel-
lant inscriptam) dimidiatam: & elegantioris literaturæ studiosi
semissem subtendentis duplum arcum appellant. Verum cum
hæc appellatio cuidam tantum sinui nempe primo competat: &
verò cum de rebus convenit, ut Cicero monet, in verborum usu
faciles nos esse oporteat: quæ causa est recedendi à nomine si-
nus hætenus retento.

Atq; hinc patet quomodo Ptolemaica de inscriptis ad sinus,
& contra sint accommodanda. Nam sinus dimidiati arcus dati
duplicatus est chorda seu subtensa dati arcus: & inscripta dupli
arcus dimidiata est sinus dati arcus.

Itaq;

- 11. *Inscripta peripheria potest quadruplum sinus di-
midia.*

Hoc



Est enim inscripta o u. dico eam posse quadruplum u s. Nam
est bisecta ad s per 10.e.& y u est dimidia peripheria totius o y u.
itaq; o u potest quadruplum dimidii per 7.e.12.R. Sequitur ra-
tio inæqualitatis segmentorum diametri.

Et *gr̃a*. Exstat propositio hæc etiam in commentariis Theonis l.2. & apud Iordanum 2.p. de ponderibus: ubi ejus usus cōspici potest.

At m est maior quam $m s$. Quare & $o y$ maior quam $y r$.

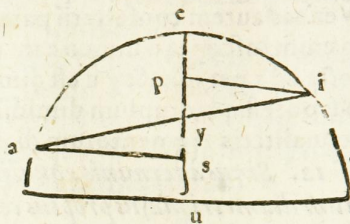
13. Si radius secet inscriptam in semicirculo segmenta
sinibus conterminorum arcuum infer radium & inscri-
ptam sunt directè proportionalia. u. c. 1. Ptolem.

Dicimus inscriptam in semicirculo sive basis sit hoc est diam-
ter, sive alia quæcunq; Ptolemæus tamen basin excludit: postu-
lat enim arcus inter terminos inscriptæ, & diametri conjunctim
minores semiperipheria: verum hoc fecit propter finem & usum
quem hinc haurire voluit nempe discretionem peripheriæ in
duas optatas.

i 3 Sit

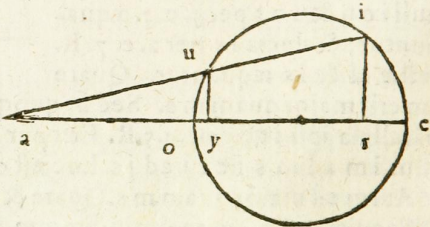
Sit itaq; inscripta ei eamq; secet radius uy & e . Sintq; arcum ie & a & sinus ip & as .

Dico ay esse ad as ut est yi ad ip . Quia enim ip & sa sunt parallelæ per 12. e. 5. R. angulus enim ad p & s rectus est: erit per 14. e. 5. R. ut ip ad iy sic sa ad ay . quare alternè & inversè.



14. Si à termino diametri continuata recta secet peripheriam: sinus à punctis sectionum recta ducta & exteriori ejus segmento directè sunt proportionales. II. c. 1. Ptol.

Esto enim diameter oe continuata in punctum a . atq; à puncto a recta secet peripheriam in u & i . & à punctis sectionum sint sinus uy , ir . Dico esse sinu ir ad ducta ia ut est sinus uy ad exteriori segmentum ua .



Demonstratio eadè est cum præcedente. Nam rectæ ai & ar sunt interceptæ parallelis uy , ir per 12. e. 5. R. Ergo segmenta conterminis parallelis sunt proportionalia per 14. e. 5. R.

Atq; ita comparatio fuit sinuum inter se & cum inscriptis: superest sinuum cum peripheriis ratio una.

15. Si sinus peripheriarum quadrantis peripheria minorum sunt æquales peripheria sunt æquales. & contra.

Elementi veritas è 10. e. & 14. e. 2. est manifesta. ut enim illic inscriptæ æquales secabāt peripherias æquales: sic hic semisses inscriptarum habent semisses peripheriarum æquales. itaq; ut illic erat ratio æqualitatis etiam inde inæqualitatis cōsequebatur: ita & hic.

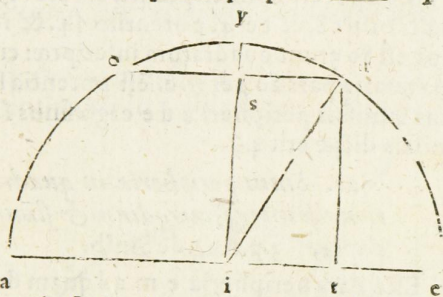
& hic. Sed id tamen notari oportet peripherias quadrantis peripheria minores hic postulari. Secus *ψευδογραφία* gravis fuerit: de qua etiam ad 8. e dixi. cum idem sinus peripheriarum duarum sit. Est itaq; speciale elementum sinuum primorum. Nam sinus secundi arcuum habent arcus æquales. nec requiritur hic ut arcus sit quadrantis peripheria minor.

16. Sinus secundus est sinus ab arcus termino in sinum primum.

Sinus secundus vulgo versus sinus dicitur: à nonnullis authoribus nescio qua similitudine sagitta: definiti potest segmentum diametri ab arcus termino ad sinum primū perpendicularare: quo

tamen verborū cumulo nō est opus. Nā si sinus est: constat qd sit perpendicularis: et si in sinum primū cadit non pot fieri quin sit segmentum diametri. Sic peripheria y u sinus secundus est recta y s à termino y in sinū primum u s perpendicularis.

Sic sinus secundus arcus u e est recta e t. arcus u y a est recta a i t.



Itaq; Radius æquatur sinui complementi peripheria quadrantis peripheria minoris & sinui secundo.

Hinc facile dati arcus datur sinus secundus. Nam si sit arcus u y sinus nempe i t 6. & radius i o. erit t e. 4. sinus secundus arcus u e.

Et

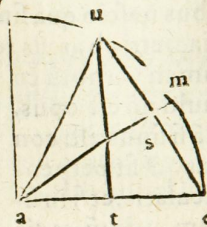
18. Sinus secundus peripherie quadrantis peripheria maioris æquatur radio & sui complementi sinui.

Esto arcus u y a ejusq; complementum u y. erit a t sinus secundus

duſ dati arcus æqualis a i radio, & i t ſinui complementi. Quare ſumma è radio & ſinu cõplemẽti, eſt dictæ peripheriæ ſinus ſecundus. ut radius ſit 10 ſinus i t 6. erit a t 16. pro ſinu ſecundo optato. Sequitur comparatio alia ſinuum inter ſe cum inſcripta.

19. *Sinus primus & ſecundus poſſunt inſcriptam ſue peripheriæ.*

Supra dixi inſcriptam poſſe quadruplum ſinus peripheriæ dimidiæ. jam docetur inventio potentitiæ inſcriptæ arcus: Et ſic Regiomontanus quærit. ut in ſubjecta figura ſi ducatur inſcripta u e. per 5. e. 12. R. u t & t e poterunt inſcriptam u e. Verbi gratia ſi ſit u t 8. & t e 4. potentitiæ 64. & 16. hoc eſt 80 erunt quadratum inſcriptæ: cuius quarta pars 20 per 11. e. eſt potentia ſinus ſemiſſis peripheriæ u e ergo ſinus ſemiſſis dictæ erit $4\frac{4}{9}$.



20. *Sinus peripheriæ in quadrante eſt medius proportionalis inter ſemiradium & ſinum ſecundum peripheriæ duplæ. 3.p.Reg.de Sinib.*

Eſto data peripheria e m ad quam dupla ſit e u. ſitq; ſinus arcus u e recta u t, peripheriæ vero e m ſit recta e s. Dico ſemiſſem a e hoc eſt radii eſſe ad e s. ut e s eſt ad e t ſinum ſecundum peripheriæ duplæ.

Sunt enim triangula a s e & u t e. æquiangula ob rectos ad s & t. communem ad e. erit ergo per 9. e. 7. R. ut a e radius ad inſcriptam u e. hoc eſt ſemiradius ad ſemiſſem inſcriptæ nempe ad e s. ut e s ad e t.

Hinc Regiomontanus investigat ſinus dimidiarum peripheriarum. ut verbi gratia ſi quæreretur e s. daretur autem u t 8. & a t 4 erit t e 6. radius a e 10. jam

ut 5 ad s e ſic s e ad 6. quare factus à 5 per 6. nempe 30 erit etiam factus ab e s per ſe. Ergo ejus latus erit $5\frac{3}{4}$. pro ſinu e s arcus dimidii ad datum e u.

4. 12. 6. 18.

2. 6. 3. 9.

e a e u e s e t

ſimiſ. ſem: ſem: ſinus 20j arcus.

Sed

Sed cognita proportionē elementum ad plures potest usus transferri.

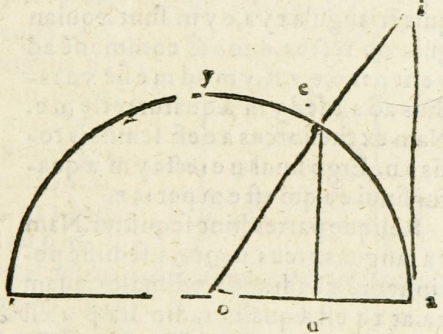
Atque hactenus sinus expeditimus: superest ut ad rectas his connexas descendamus.

21. *Recta sinibus connexa est tangens peripheria aut eam secans.*

Proposuimus ut in circulo inscriptas, sic in semicirculo sinus perpendendos sed & rectas sinibus connexas. Eas plenioris intellectus causa in tangentes & secantes dislocamus. Verbis si, hāc in re non nova, novis: tamen ut speramus accommodatis.

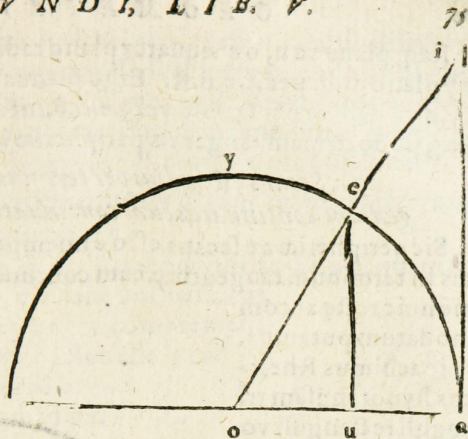
22. *Tangens est à termino peripheria altero perpendicularis in radium extra per reliquum terminum continuatum.*

Esto peripheria a e. sitq; ab ejus termino a perpendicularis a i terminata in radio o e continuato in i. per reliquum datae peripheriae terminum. erit a i tangens datae peripheriae. Sic vocare placuit quia sit perpendicularis extremæ diametro. hoc dato per i. e. z erit tangens: itaq; Geometria ipsa commodum suppeditavit nomen: nec aliunde adferri comodius poterit. Nam quod quidam numerum secundum rectam a i vocant, id ii videant quomodo defendant: mihi non probabunt. Damus aliquid peritissimo illi artifice Regiomontano homini Germano: qui primus hujus vocabuli author dicitur: damus etiam aliquid receptæ consuetudini. Verum id non facile damus ut verba ea in usu retineamus quibus elegantiora, breviora, significantiora, veriora habeamus.



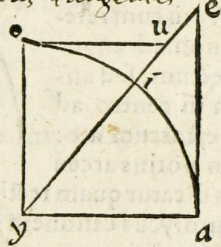
k Rhoticus

Sit in subiecta figura peripheria quide
ra peripheria quide
ye finus ou. sitq; cõ-
plemētum ea cujus
finus eu. sitque tan-
gens cõplemēti i a.
Quia triāgula æqui-
angula erit ut ou ad
ue sic oa radius ad
ai. Et hinc intelligi
potest tangentē pe-
ripheriæ competere
etiam reliquæ ad se-
miperipheriam.



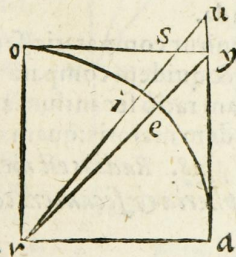
25. Radius est medius proportionalis inter tangentes
peripheriæ & complementi.

Sit peripheria ai ejusque com-
plementum io. sitq; tangens il-
lic ae hic vero ou. jam quia duo
triangula y o u, e a y sunt rectan-
gula & angulus ye a angulo u y o
æquetur per 12. e. 5. R. erunt æqui-
angula. itaq; per 9. e. 7. R. ut ae ad
ay radium sic y o radius ad ou.



26. Tangentes peripheriarum tangentibus complemen-
torum sunt reciproce proportionales.

Esto sint peripheriæ ae & ai
earumque complementa oe, oi.
sintque earum tangentes ay, au,
os, oy. Dico jam au esse ad ay ut
est oy ad os. Nam per præmissum
elementum est



ut au ad radium sic rad. ad os.
ut ay ad radium sic rad. ad oy.

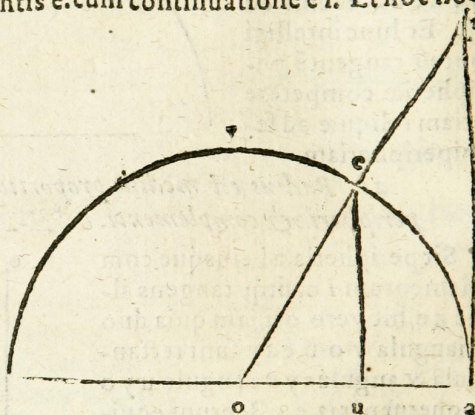
k 2 Itaq;

Itaq; planus au , os æquatur plano radii itemque planus ay , oy plano radii per 4.e.11.R. Ergo planus au , os æquatur plano ay , oy . Quare per 14.e.10 vel 5.e.11.R. ut au ad ay sic oy ad os . Atq; sic doctrinam tangentis peripheriæ expeditimus. *doctrina se-
cutum*

27. *Secans est radius per terminum peripheriæ in tan-
gentem continuatus cum continuatione.*

Sic peripheriæ ae secans est oe i. nempe radius oe continua-
tus in terminum tangentis e . cum continuatione ei . Et hoc no-
mé huic rectę accom-
modatum putamus.

Joachimus Rheti-
cus hypotenusam tri-
anguli rectanguli vo-
cat respectu anguli
recti ad a cui subten-
ditur. Verū cum refe-
ratur non ad angu-
lum rectum, sed an-
gulum in centro ad
 o hoc est arcum a e :
an non potius arcus



secans dicatur quam recti anguli hypotenusam judicent alii.

Maurolycus canonem Rhetici paulò mutatum in Messanensi
Menelai editione, nomine etiam mutato edidit: & beneficum
vocavit: tanquam recta oi seu numerus hanc definiens benefi-
cus diceretur. At recta oi non magis est benefica, quam recta ai
fecunda.

Sequitur comparatio secantium cum sinibus, & cum tangen-
tibus. & quidem comparatio cum sinibus priori loco: & propor-
tio Nam ratio secantium ad radium, ad sinus est inæqualitatis,
& quidem majoris: quam determinare non fuerit necessum.

28. *Radius est medius proportionalis inter sinum peri-
pheriæ & secantem complementi.*

Hoc

Hoc etiam elementum Et. Rheinholdi est in tabulis directio-
num præcepto 8. Esto in præmissio schemate arcus dati $a e$ sinus
eu, secans o i. dico esse ut $o u$ sinum complementi datæ periphe-
riæ ad $o a$ radium sic $o e$ radium ad $o i$. Sunt enim triangula $i o a$,
 $e o u$ æquiangularia. ideoq; per 9. e. 7. R. cruribus proportionalia.

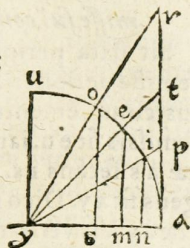
29 *Secantes peripheriarum sinibus complementorum
sunt reciproce proportionales.*

Sint enim in subiecta figura datæ peripheriæ $a e$, $a o$: quarum
complementa sint $e u$, $o u$. jam sint datarum
peripheriarum secantes $y t$, $y r$. complemen-
torum vero sinus $y m$, $y s$. Dico esse $y r$ ad $y t$
ut est $y m$ ad $y s$. Nam per 28. e.

ut $y r$ ad radium sic rad. ad $y s$.

ut $y t$ ad radium sic rad. ad $y m$.

Quare planus $y r$, $y s$ item $y t$, $y m$ sigillatim
æquatur plano radii per 4. e. 11. R. Ergo & in-
ter se: eritque per 14. e. 10. R. ut $y r$ ad $y t$ sic $y m$
ad $y s$. Sequitur deinceps comparatio secan-
tis cum tangente. & primo ratio æqualitatis.

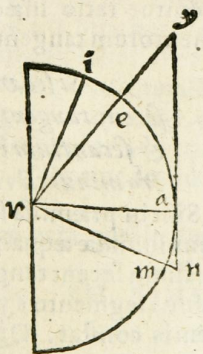


130. *Secans periphæria æquatur tangenti & datæ & se-
missis complementi.*

Sit periphæria data $a e$. semissisq; com-
plementi ejus $a m$. jam sit secans datæ $r y$.
tangens ejusdem $y a$. semissis cõplemen-
ti $a n$. hoc est tangens datæ & semissis
cõplementi sit $y n$. Dico $y r$ & $y n$ æquari.
Elementi veritas patet è 10. e. 6. R. Nam
angulus $r n y$ & $y r n$ æquantur. Etenim.

Reliqua æqualium de æqualibus æ-
quantur.

At anguli $r n y$ & $y r n$ sunt reliqui æ-
qualium $i r e$ & $a r n$ ex thesi (uterq; enim
subtenditur à semisse complementi datæ



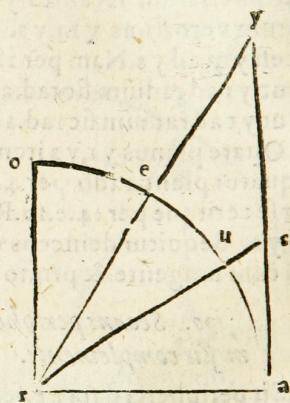
k 3 periphæria

peripheriæ itaq; per 5. e. 3. sunt æquales) sunt reliqui, inquam, æqualium de æqualibus i r n & r a y quia hi recti sunt. Quod autem angulus a r n de angulo r a y relinquat angulum r n a patet per 2. c. 9. e. 6. R. Rectus enim æquatur duobus oppositis interioribus. Ergo minutus altero interiorum, est reliquus.

Ergo dicti anguli sunt æquales: proinde à lateribus æqualibus subtenfi. *secans peripheriæ minoris & tangens*

31. *Secans peripheriæ, quadrantis peripheriæ semisse minoris, cum tangente eiusdem æquatur tangenti datæ semisse sui complementi autæ.*

Sit data peripheria a u minor semisse peripheriæ quadrantis: ejus complementum sit u o. cujus semissis sit e u. jam sit tangens datæ a s secans r s. at arcus a e tangens sit a y. Dico r s, s a æquari rectæ a y. Vis veritatis in eo consistit, ut monstretur æqualitas r s & s y. Nam a s per se sibi æquatur. per 12. e. 5. R. itaq; o r hoc est ex thesi y r s æquatur angulo r y s. Quare per 10. e. 6. R. r s & s y æquantur. Sequitur ratio inæqualitatis segmentorum tangents & secantis.



32. *Si secantes per terminos æqualium peripheriarum secant tangentem summa æqualium, segmentum tangents & secantium extra peripheriam propius extrema diametro minus est remotiore.*

Sint in præmissa figura æquales peripheriæ a u, u e. Sitq; tangens summa æqualium nempe a u e recta a y & per terminos æqualium secant tangentem secantes r s, r y. Erit segmentum s a minus segmento s y. & u s minus quam e y. De segmentis tangents constar. Quia enim e a peripheria bisecatur in u per r s & angulo

& angulus yra erit bisectus per 5.e.3. itaq; per 12.e.6. R. ut ra ad ry sita s ad $s y$.

Verum ra est minor quam ry per 11.e.6 R.

De secantibus facilis res est: rs minor est quam ry per 11.e.6 R. auferatur æqualis radius: u s minor quam $e y$ relinquetur.

Itaq;

33 Si secantes secant e tangente segmenta æqualia: segmentum peripheriæ propius extrema diametro remotiore majus est.

Hoc elemento Euclides in opticis utitur 4 & 7 theor. ad demonstrationem inæqualitatis rerum visarum quo ad visum: quæ æquales tamen existunt. Est autem manifesta veritas è præcedente. Ponatur enim in præmisso figura segmentum $a s$ æquale segmento $s y$. Dico peripheriam $a u$ esse majorem peripheria $u e$.

Nam si peripheriæ $a u, u e$ non sunt inæquales: secantes per earum terminos secabunt segmenta $a s, s y$ in æqualia. per 32.e.

At hic ex thesi non secant inæqualia. Quare sunt inæquales. Et $a u$ major est quam $u e$. Si enim esset æqualis & proinde multo magis si minor: $a s$ esset minor quam $s y$.

At non est minor ex thesi. posset institui alia demonstratio: si centro a . radio rs describeretur peripheria: fieret sector major ad extremam diametrum: minor qui esset remotior: unde angulus sra major concluderetur angulo rys per 6.e.3. & hinc per 5.e.3. peripheria $a u$ major quam $u e$. Alio adhuc modo scholastes Euclidis opticus demonstrat. Ducta enim recta ex s quæ parallela sit ad ra , facit angulum $eum rs$ æqualem angulo sra per 12.e.5. R. Et cum ille major sit angulo rys per 11.e.6. R. angulus sra etiam eodem major erit. itaq; & $a u$ major quam $u e$. Quemadmodum illic videri poterit.

Expedivimus itaq; doctrinam circularem eam quæ in lineis fuit atq; segmentis.

TH. FINKII

GEOMETRIAE
 TH. FINKII GEOME-
 TRIAE ROTVNDI,
 LIBER SEXTVS.

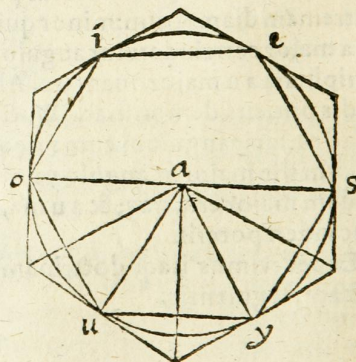
De adscriptione circuli & trianguli.



Geometria circularis simplex expedita est: sequitur cōiuncta in adscriptione circuli & rectilinei.
 Geometriam circularem nobis duplicē proposuimus: simplicem quidem solius circuli cum suis lineis & segmentis: cōiunctam vero in adscriptione circuli & rectilinei ponimus. Cognitionem rectilíneorum ē Geometria vel Euclidis vel Rami huc adferri necesse est: nos ea saltem docebimus quæ circulum attingunt.

2. *Si rectilineum adscriptum circulo est æquilaterum: est æquiangulum.*

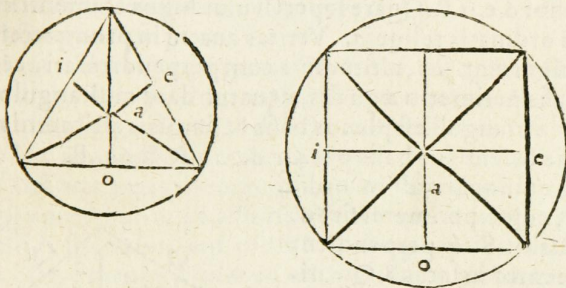
Campanus hoc ad 15. p. 4. proponit. Veritas autem docenda erit & in inscripto & circumscripto. Tot enim species adscriptionis sunt 10. e. 1. R. primo itaq; de inscripto. id si triangulum est per 2. c. 10. e. 6. R. est æquiangulū. De triangulato itaque res demonstranda: ut hic si inscriptæ *ou* & *sy* sint æquales subtendent peripherias æquales per 14. e. 2. jam si æqualibus *ou* & *sy* addas æquale nempe peripheriā *ois* summæ *uoies* & *ysei* sunt æquales. Ergo per 5. e. 3. angulus *uys* an-



gulo

gulo y d est æqualis. Eodemq; modo reliqui anguli æquales probabuntur. De circumscripto etiam pater si intelligas circumscriptum circum. perpendiculares enim à centro a. in latera circumscripti cum radiis facient utrinq; triacula æquilatera per 5. e. 12. R. & per 1. e. 7. R. æquiangula. Quod si ergo anguli à radiis & circumscripti lateribus æquantur toti à lateribus comprehensi æquabuntur.

3. Si rectilineum adscriptum circulo est æquilaterum: æquatur triangulo æqualis basis quidem perimetro, altitudinis autem perpendiculari à centro in latus. Sit inscriptum triangulum itemq; quadratum.



Dico triangulo huic æquari triangulum, cujus basis sit continuata è tribus lateribus, altitudo sit perpendicularis è centro communi rectilinei & adscripti circuli. Veritas est manifesta ex 1. c. 6. e. 7. R. Nam si à centro ducantur radii tres in angulos dati trianguli fient tria triacula quæ sunt æquealta. Altitudo enim est perpendicularis à vertice in basin hoc est à centro in latus: ea autem hic est æqualis per 23. e. 1. in tribus triaculis. Et in æquali sunt basi nempe latere trianguli æquilateri. jam quia triaculum è basi perimetro, altitudine perpendiculari à centro in latus est æquealtum triaculis tribus, & basin habet basibus horum
1 æqualem

æqualem nempe ex iis compositam: æquatur uniuersis: æqualibus dato triangulo.

Eodem modo in quadrato res patet. Nam ductis diagoniis fiunt quatuor triangula æque alta æqualia dato. at his quatuor, æque altum & æquale basibus triangulum è perimetro quadrati & perpendiculari dicta æquatur. Et sic de quolibet rectilineo ordinato induces.

Itaq;

4. *Planus è perpendicularis è centro in latus & perimetri altero per reliqui dimidium est area rectilinei ordinati.*

Hæc geodælia rectilinei ordinati communis est. Ac in triangulo expeditior est 4. c. 6. e. 10. R. aut 9. e. 12. Quadrati quoq; compendiosior 6. e. 11. R. Quare superest usus huius elementi in multangulis ordinatis reliquis. Veritas autem in promptu est. Nam triangulum æqualis, altitudinis cum perpendiculari à centro in latus, basis perimetro æqualis, æquatur dato multangulo.

At area trianguli est planus basis & semissis altitudinis aut altitudinis & semissis basis per 4. c. 6. e. 10. R. & 6. 11. R.

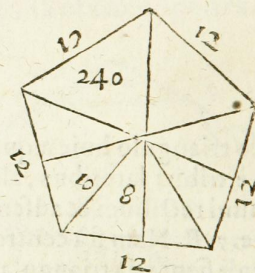
Esto quinquangulum ordinatum, cuius perimeter sit 60. erit latus 12. Sitq; perpendicularis à centro in latus 8. Quæritur area quinquanguli. planus è 30 & 8. est 240. pro quæsita area. Vel planus è 60 per 4 est 240. rursus pro area optata.

Esto rursus sexangulum: cuius latus sit pedum 8, & perpendicularis à centro in latus sit $6\frac{1}{3}$.

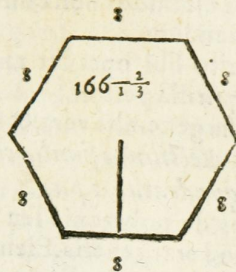
Planus ergo à $6\frac{1}{3}$ per 24 est $166\frac{2}{3}$. per area.

At dices: unde scis perpendicularem esse in quinquangulo dato pedum 8 in sexangulo pedum $6\frac{1}{3}$.

Id, inquam, hic dari oportet: aliàs patebit inventio ejus è radio



dio circumscripti circuli
& semisse lateris multan-
guli, in triangulo rectan-
gulo. Nam quadratum se-
missis lateris de quadra-
to radii relinquit quadra-
tum perpendicularis per
5. e. 12. R. ut melius intel-
ligetur ad doctrinam cir-
cumscriptionis circuli. Nos
hic cum matre filiam con-
jungere maluimus: quam
interpositis aliis sejungere.



Sunt qui geodesiā pro-
ponunt specialem: Verbi gratia Cardanus in practica sua arith-
metica dicit, esse quadratum lateris quinquanguli ad aream
ejus, ut 2,939 ad 5,056. Quod verum non est: Nam si sit ut 2,939
ad 5,056 sic quadratum lateris ad aream: erit ut 2,939 ad 5,056 sic
144 ad 248 fere. aream nempe quinquanguli. Quæ certè magna
ψευδογραφία est. pro 240 assumere pedes quadratos 248. Quod
si ejusmodi speciales sunt constituendæ geodæsiæ: ex inuenta
area, & latere mensuræ quanto majoris tanto ad hanc rem me-
lioris: termini rationis minimi potentia lateris ad aream consti-
tui debent: & tamen nullius esse momenti deprehendes. in no-
stro exemplo area est 240. quadratum lateris 144. Horum maxi-
ma mensura communis est 48. Ergo 240. & 144, in terminis mi-
nimis proportionalibus sunt 5. ad 3. Quare ut 3 ad 5 sic quadra-
tum lateris quinquanguli ad aream. Verum est in hoc exem-
plo. At si latus quinquanguli 20. erit perpendicularis pedum
 $13\frac{3}{5}\frac{8}{10}\frac{1}{10}\frac{2}{10}\frac{1}{10}$.

Jam planus est 50 semissis perimetri & perpendiculari est 688.
& parum ultra pro area quinquanguli. Sed si terminos primi no-
stri exempli teneas: erit ut 3 ad 5 sic 400, quadratum lateris ad
666 pro area. En novam *ψευδογραφίαν* in primo exemplo ter-
mini

mini hi erant rationis quadrati lateris ad aream: at in hoc vides quantum aberrant. Hinc ergo iudicium facere poteris: quid de specialibus ejusmodi non tam Cardani quam aliorum geodæsiis sit sentiendum.

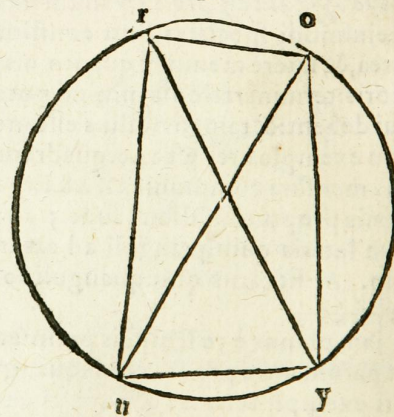
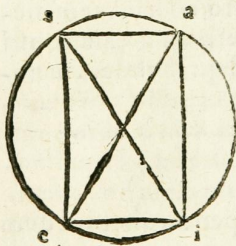
Hic merito sibi optasset tantum quotannis agri quantum $\Psi\upsilon\delta\sigma\pi\alpha\phi\iota\alpha$ illa periret.

Geodæsia generalis vera, & facilis est. Ea igitur teneatur.

5. *Rectilinea similia circulis inscripta sunt ut à diametris quadrata. 1.p.12.*

Euclides de polygonis seu multangulis proponit, de specie scilicet quod erat generis. Elementum vero hinc patet quod plana similia habeant duplicatam rationem homologorum laterum per 1.e.6.R. Est autem duplicare rationem homologorum laterum quadrare diametros.

¶ Jam vero in inscriptis rectilineis diametri sunt homologa latera aut homologis lateribus proportionales. ut patet primò in triangulis. Ea sunt rectangula aut obliquangula. Sint ergo rectangula a e i, o u y. quia itaque a e & o u sunt diametri per 4.e.4. res protinus patet: sunt enim diametri homologa latera ipsorum



triangu-

triangulorum. Sed sint jam obliquangula $i s e, y r u$. diametri erunt homologis lateribus proportionales nempe lateribus $e i, u y$ ut jam patuit: & ideo ut diametri $a e, o u$. Si triangulata sint, in sua resolventur triangula per 2.e.10.R. & res patebit similiter.

Itaq;

6. Si sit ut diameter circuli ad latus rectilinei inscripti, sic diameter secundi circuli ad latus secundi rectilinei inscripti, triangulaq; inscriptorum singularia similia similiterq; sita: rectilinea inscripta erunt similia similiterq; sita.

Confectarium hoc Euclides 2. p. 12. sic sumpsit: & ideo nos hinc concludimus. ut si sit in præmissa figura ut, $o u$ ad $u y$ sic $a e$ ad $e i$ & triangula $o u y, a e i$ similia similiterq; sita itemq; triangula $o u r, a e s$ erunt inscripta quadrangula similia similiterq; sita

7. Rectilineum inscribitur circulo quando peripheria tangit angulos: Circumscribitur cum a singulis lateribus peripheria tangitur. 3.4.d.4.

Hæc ex generali adscriptionis doctrina in hæc species deducuntur. Est enim circuli terminus peripheria: Si ergo peripheria rectilinei terminis terminetur: circulus & rectilineum adscripta inter se sunt &c. Et hinc patet adscriptionem quidem circuli esse cum triangulo quolibet: cum triangulato autem duntaxat ordinato.

8. Si dua rectæ bisecent duos angulos dati rectilinei: circulus radii ab earum concursu in latus perpendicularis inscribetur dato rectilineo. 4.8.13.p.4.

Esto verbi gratia triangulum $a e i$. & rectæ $e u, a o$ bisecent angulos $i a e, i e a$: & ab earum concursu sint perpendiculares in latus $y s, y o, y u$. dico radio $y u$ vel $y o$ vel $y s$ centro y describi circulum. per 27. e. 1. Sunt enim tres ab eodem puncto æquales. Nam bisecantes cum perpendicularibus faciunt per 2.e.7. R. triangula æquilatera. Nam triangula $s e y, y e o$ sunt æqua angulis ad e ex thesi & s, o , æqualis basis $y e$ quia communis. Ergo $s y, y o$

1 3 æquan-

enim in triangulo quolibet possumus habere commune punctum a quo circulus tangit peripheriam. At id in tribus triangulis non fiet.

hoc vides
is: quid de
m geoda.
quantum

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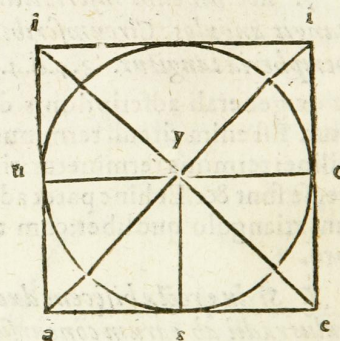
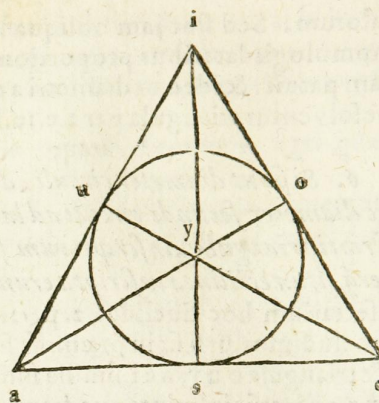
omologa la
ter primo in
ut ergo rectu
per 4. e. 4. 10
latera ipsorum



triangulo

æquatur. rursus $s a y$,
 $y a u$ eodem modo
 sunt æquilatera. unde
 $\& u y \& y s$ æquan-
 tur. proindeque tres
 perpendiculares sunt
 æquales ab eodem
 puncto $\&$ quidẽ cen-
 tro. idem argumen-
 tum in triangulato
 erit. ut exempli gra-
 tia hic in quadrato
 videbis.

Nam $\&$ hic per-
 pendiculares tres
 $y o. y s. y u$ simili ra-
 tiocinatione æquā-
 tur pro radiis circu-
 li cui quadratũ est
 circumscriptũ. Est
 autem tum rectili-
 neum circumscri-
 ptum quia periphe-
 ria à lateribus tan-
 gitur.



9. Si due rectæ rectè bisecent duo latera dati rectilinei:
 circuli radii ab earum concursu in angulum circumscri-
 betur dato rectilineo. s. 9. 14. p. 4.

ut in superioribus figuris rectæ $y o, y u$ rectè bisecent latera $e i$,
 $a i$ dico circulum à centro y radio $y e$, vel $y i$ vel $y a$ circumscribi
 dato rectilineo, sunt enim tres dictæ æquales. Nam ducta recta
 $y i$ triangulum $y o i$, triangulo $y o e$ est angulo æquicruro æquum
 ex thesi

ex thesi. Sic & triangulum $y u i$ triangulo $y u a$. Ergo per 2.e.7.R. $e y, i$ & $y i, a$ æquantur. & proinde per 27 e i. centrum est in y . ex quo radio $y e$ circumscribitur circulus

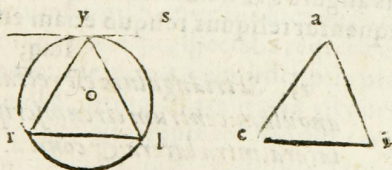
Itaq;

10. *Segmenta ex concursu bisecantium angulos rectilinei ordinati, sunt radii circumscripti circulis.*

ut in superioribus figuris $u e$, & $o a$ bisecant angulos. harum concursus est in y centro rectilinei, circuli & inscripti & circumscripti. quare $y e, y a$ sunt radii circumscripti. Atq; hinc patet inventio perpendicularis à centro in latus cujus cognitio ad geodæsiam rectilinei uecessaria est. Quia enim $y e, y a$ sunt radii: $a e$ erit inscripta & in eam $y s$ est perpendicularis: $a s$ & $s e$ æquabuntur. jam si de quadrato $y e$ tollas quadratum $s e$ semissis lateris relinquetur quadratum perpendicularis quæsitæ. Atq; hætenus adscriptio circuli fuit: sequitur adscriptio rectilinei, & primo quidem trianguli.

11. *Si duæ inscriptæ à contactu rectæ & peripheriæ æquent duos utring, angulos duobus angulis dati trianguli: connexæ inscribent triangulum dato circulo æquiangulum dato triangulo. 2.p.4.*

Detur itaq; triangulum $a e i$: offeratur etiam circulus o . Huic inscribendum sit triangulum æquiangulum dato. Ducatur itaq; tangens $u y s$ quæ tangat, inquam, peripheriam $y r l$. atq; a contactu inscriptæ $y r$ & $y l$ æquent angulos $u y r, s y l$ angulis dati trianguli $a e i, a i e$ & connectantur inscriptæ rectæ $r l$. Dico triangulum $y r l$ esse æquiangulum dato. Nam si bini anguli duorū triangulorum æquatur, reliqui æquantur per c.3.e.7.R.



At hic anguli l & i anguli e & i æquantur. Quia angulus $y l r$ æquatur

æquatur angulo $y r$ per 18. e. 3. hoc est angulo $a e i$. item angulus $y r l$. æquatur angulo $s y l$ hoc est angulo $a i e$. Ergo angulus a æquatur angulo y .

12. Si duo anguli in centro dati circuli æquētur ad commune latus exterioribus angulis dati trianguli: rectæ tangentēs peripheriam in cruribus angulorum circumscribent triangulum dato circulo æquiangulum dato. 3.p.4.

Esto triangulum $a e o$. ejusq; exteriores anguli $a e i$, $a o u$. circulus autem datus $y s r$. tum in centro ejus l ad commune latus $l r$ æquantur anguli exteriorib. dati trianguli, $y l r$

quidē angulo $a e i$, at $r l s$ angulo $a o u$. jam sint tangentēs ad r, y, s quæ circumscribant triangulum.

Dico id esse dato æquiangulum. Nam per 4. e. 6.

R. anguli in quadrangulo $y m r l$ æquantur quatuor rectis. Sed anguli ad y &

r sunt recti ex fabrica & 1. e. 2. Ergo reliqui ad l & m æquantur duobus rectis. quibus etiam æquantur anguli $a e i$, $a o p$ per 1. c. 8. e. 5. R. Ergo ablati æqualibus $a e i$ & $y l r$ ex fabrica de æqualibus relinquitur $y m r$ æqualis angulo $a e o$.

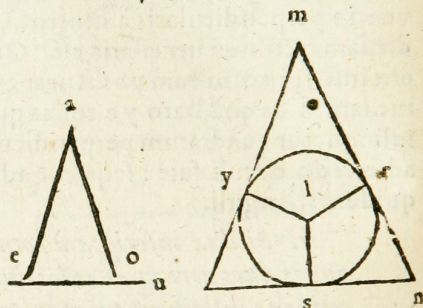
Eodem argumento angulus trianguli circumscripti oppositus angulo $s l r$ nempe $r n s$ æquatur angulo $a o e$. itaq; cum bini æquantur reliquis reliquo etiam erit æqualis per c. 3. e. 7. R.

Itaq;

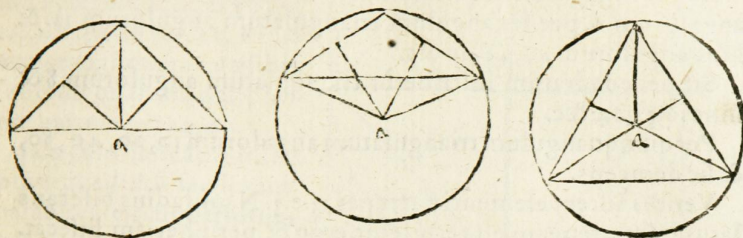
13. Si triangulum est rectangulum, obtusangulum, acutangulum: centrum circumscripti circuli est in latere, extra latera, intra latera: & contra.

Elementi veritas è præmisso auxilio 4. e. 4. manifesta est. Nam rectangulum tantum inscribitur semicirculo: ergo in latere sive basi, hoc est diametro, est centrum.

Obtusangulum



Obtusangulum tantum inscribi potest minori sectioni. Ergo centrum extra basin. Sic acutangulum inscribitur majori sectioni ergo intra latera centrum consistat necesse est, ut hic subjectæ figuræ centrum a exhibent.



TH. FINKII GEOMETRIÆ ROTVNDI,
LIBER SEPTIMVS.

De adscriptione triangulati.



Si recta tangant peripheriam in angulis inscripti triangulati ordinati: circumscribent triangulatum circulo homogeneum inscripto. 7.12.p.4.

Expedita est adscriptio circuli, adscriptio item trianguli: superest adscriptio triangulati & quidem ordinati: cuius circumscriptio generalis hic proponitur ex antecedente tamen inscriptione quæ specialia requirit elementa. Exempla autem per species deinceps cum inscriptis proponetur. Et hoc generale semel & primo dicere satius est quam in quadrangulo quinquangulo speciatim repetere. Sequitur ergo inscriptio & quidem per unicum latus, quod repetitum quoties opus est peripheriam compleat. Fecit hoc Euclides in quinquangulo: nec malè tamen in reliquis eadem ratio instituitur.

m 2. Si

2. Si radius bifecet latus inscripti ordinati: recta inter terminum radii atq; lateris est latus inscripti ordinati ad predictum lateribus dupli.

Ita per triangulum æquilaterum inscribi potest triangulatum angulorum 6. per sexangulum triangulatum angulorum 12. & hinc angulorum 24, 48, 96 &c.

Sic per quadratum inscribetur triangulatum angulorum 8 & hinc 16, 32, 64 &c.

Per quinquangulum triangulatum angulorum 10, 20, 40, 80, & sic deinceps.

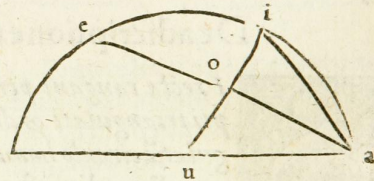
Veritas autem elementi pater per 13. e. 3. Nam radius bifecans latus inscripti per 19. e. 1. rectè secat. ergo & peripheriam bifecat. Quare quam peripheriam subtendebat recta una: eam jam duæ æquales rectæ subtendunt. itaq; inscribitur hoc modo ordinatum duplum. Quod si latus inscripti dati detur in numeris: nota diametro ex superioribus præceptis latus inscripti dupli manifestum erit per 12. e. 4. aut per 19. e. 5. Exempli gratia, esto inscriptum latus trianguli æquilateri a e 173, 205. radius bifecās a e in o, bifecat etiam arcum a e in i. erit ergo a i latus sexanguli ordinati. id inveniet hoc modo: datur a o tanquam sinus peripheriæ a i. ergo per 9.

e. 5. dabitur o u sinus complementi 50,000. jam ablato o u de radio 100,000. relinquitur o i sinus secundus arcus a i. jam per 19 e. 5. a i dabitur 100,000 latus inscripti sexanguli. Et sic in reliquis. Ptolemaica via è 12. e. 4. eodem modo inscriptam a i inveniet.

3. Si diametri rectè intersecantur: subtensa recto erit latus quadrati. 6. p. 4.

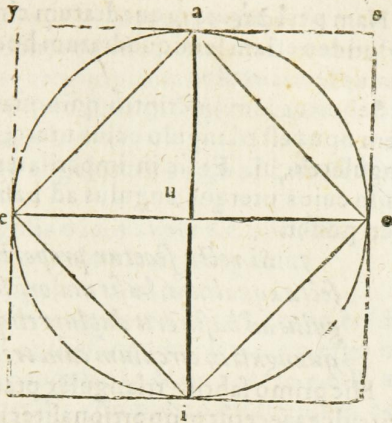
Esto circulus a e i o. cujus diametri e o, a i rectè intersecantur ad u. rectoq; subtensa sit a o, dico a o esse latus quadrati inscripti.

Crura



Crura enim recti u a, u o
item u a, u e & u e, u i & u i,
u o sunt radii: & rectis con
nexi triangula æqua angu
lo equicrura sunt: ergo per
2.e.7.R. bases a o, a e, e i, i o
æquantur: quare quælibet
subtrahit quartam periphe
riæ partem per 14.e.2.

jam cum habeatur inscri
ptum quadratū facile com
parabitur circumscriptum
per i.e.



Itaq;

4. *Latus inscripti quadrati potest duplum circularis radii.*

ut in præmissa figura a o æquè potest per 5.e.12.R. cruribus a u,
u o. At horum quadrata sunt æqualia: cum latera sint æqualia.
Ergo ad alterutrum quadratum, quadratum a o erit duplum. Et
hinc Ptolemæus 9.c.1. investigat latus inscripti quadrati. Nam si
quadratum radii duplicetur, latus duplicati erit inscripti quadra
ti latus. ut si radius sit 10,000,000. a o erit 14,142,136 ferè.

Et

5. *Quadratum inscriptum est dimidium circumscri
pti. in 2.p.12.*

In promptu causa est quia e o diameter hoc est latus circum
scripti y s æque potest cruribus e a, a o lateribus nempe inscri
pti. At latera hæc sunt æqualia. Quare quadratum y s est duplum
ad quadratum lateris inscripti.

Et

6. *Quadratum inscriptum est majus dimidio circum
scripti circuli.*

m 2 Nam

Nam per i & o quadratum circumscriptum est majus circulo: ideo etiam semiquadratum hoc est inscriptum quadratum majus semicirculo.

Sequitur jam inscriptio quinquanguli: ad cujus inscriptionem opus est triangulo cujus uterq; angulus ad basin duplus sit anguli reliqui. Et sic in imparilateris reliquis opus esset triangulo cujus uterque angulus ad basin sit multipus reliqui: si haberi posset.

7. Si recta secetur proportionaliter: trianguli crurum secta equalium, basis majori segmento equalis, uterq; angulus ad basin erit duplus reliqui: & basis erit latus quinquanguli in circulum cum triangulo inscripti. 10.11.p.4.

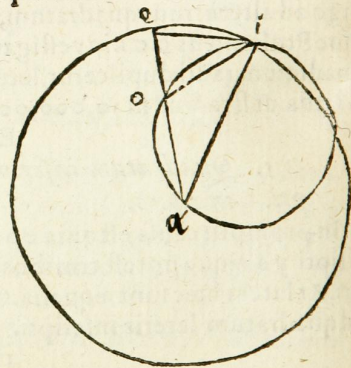
Hic primo fabrica trianguli optati erit. Sit recta a e pro radio circuli: ea secetur proportionaliter per 3.e.14.R. in puncto o . describatur circulus radio a e. tumq; per 11.e.1. a termino e inscribatur e i equalis majori segmento a o. & terminus i connectatur cum centro a . Fiet triangulum æquicrurum cujus anguli e & i æquantur: ut quod de uno probatum sit de reliquo quoq; verum habeatur. Et hoc est triangulum optatum.

Ducatur enim recta i o & per 9.e.6. triangulo i o a circulus circumscribatur.

Hunc circulum tanget recta e i. Nam ex thesi ut a e ad a o hoc est e i sic e i ad e o. Ergo per 4.e.12.R. oblongum a e, e o æquatur quadrato reliquæ e i. Ergo per 9.e.2. reliqua ipsa e i tangit datam peripheriam.

Itaque hinc sequitur quod angulus e i a duplus sit anguli ad a .

Nam æqualis duobus æqualibus est duplus alterius: At angulus



lus e i a est æqualis angulis a i o, o a i æqualibus inter se.

Assumptionis partes duæ sunt: quod e i a angulus æquetur di-
ctis duobus: quod duo isti æquantur. prima hinc patet. quia an-
gulus e i o æquatur angulo o a i in alterno segmento per 18. e. 3.
& reliquus a i o æquatur sibi ipsi.

Secundo, æqualitas horum angulorum o i a, o a i inter se hinc
manifesta est.

Angulus e o i æquatur angulis o i a, o a i per 2. c. 9. e. 6. R.

Anguli o i a, o a i æquantur angulo e i a ut jam patuit.

At angulus e i a æquatur angulo o e i ex thesi.

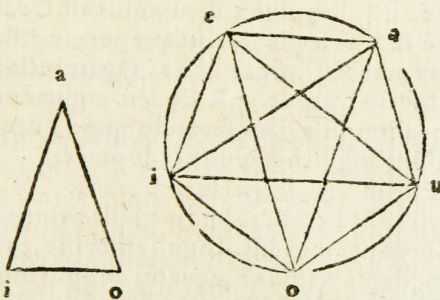
Quare angulus e o i æquatur angulo o e i: itaq; per 10. e. 6. R.
o i æquabitur lateri e i. At e i ex thesi æquatur lateri a o. ergo o i
æquatur lateri o a. & proinde anguli o i a & o a i per 10. e. 6. R. æ-
quantur. Et hinc jam generalis complexio est angulum e i a
esse duplum anguli e a i.

Et sic fabrica trianguli optati fuit: Secundo jam erit inscriptio
quinquanguli. Dico itaq; basin e i esse latus quinquanguli cum
triangulo inscripti.

Inscribatur enim tri-
angulum a i o æquian-
gulum invento per 11.
e. 6. erit basis i o latus
quinquanguli inscri-
pti. Etenim sint duæ
rectæ bisecantes angu-
lum utrumque reliqui
duplum: & conectan-
tur cum angulis & in-
ter se fient latera i o, i
e, e a, a u, u o, æqua-
lia. Nam cum anguli quinq; bisecti duo & reliquus sint æquales:

per 5. e. 3. peripheriæ quinque æquabuntur: & per 14. e. 2. inscri-
ptæ, hoc est ipsa latera sunt æqualia. jam inscripto quinquangu-
lo facile erit per 1. e. quinquangulum ordinatum circumscribere.

m 3 Et



Et sic recta proportionaliter secta quinquanguli adscriptio-
nem machinatur: sed & inde vicissim redditur linea proportio-
naliter secta.

8. Si due recte subrendunt duos deinceps angulos in-
scripti quinquanguli secantur proportionaliter, & mayo-
ra segmenta sunt latera inscripti. 8.p.13.

Elementi partes duæ sunt: rectas secari proportionaliter: ma-
jora segmenta esse æqualia lateribus inscripti quinquanguli.

Esto igitur inscriptum quinquangulum: & rectæ a i, u e sub-
tendentes angulos deinceps a e i,
u a e. Dico eas proportionali-
ter secari in s. secundo maiora se-
gmenta si, s u æuari lateribus
inscripti. Quia itaque triangula

Triangula æquiangula
sunt proportionalia em
nbg. g e. 7. Triang.
ba a s e. a e i
sunt triangula æquan-
gula etc.

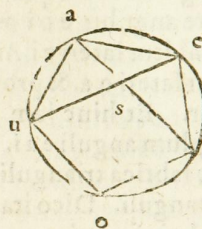
2.e.6. æquicrura ex thesi: sunt æ-
quilatera per 2.e.7. R. & per 1.e.
7.R. æquiangula. & anguli a i e,
a e u æquales. Sed in triangulis

s e a, e a i angulus a communis est. Quare per c.3.e.7.R. anguli
a s e & a e i æquantur. itaque per 9.e.7.R. uti a ad a e hoc est (ut
mox patebit) i s sic a e ad a s. Quare recta i a secta est proportio-
naliter in s. per 1.e.14.R. Eodem argumento u e secta est propor-
tionaliter in s. jam secundo quod i s æquetur lateri inscripti
quinquanguli nempe a e inde patet.

Eidem æqualia sibi sunt æqualia.

At i s & a e sunt eidem æqualia nempe e i. & quidē a e ex thesi
i s vero per 10.e.6.R. Anguli enim i e s, e s i æquantur quia eidem
sunt dupli. Nam i s e æquatur duobus interioribus s a e, a e s per
2.c.9.e.6.R. æqualibus per 5.e.3. itaq; alterius duplus est nempe
anguli a e s. Sed & huius duplus est angulus u e i per 5.e.3. insi-
stens nempe in dupla peripheria. Et hinc sequitur complexio
quæsita. Ergo e i, i s sunt æquales. Atq; hinc patet fabrica quin-
quanguli ordinati super datam rectam: quam sequenti consecta-
rio exponemus.

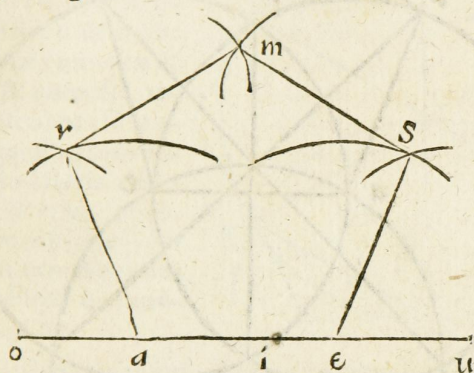
Itaq;



Itaq;

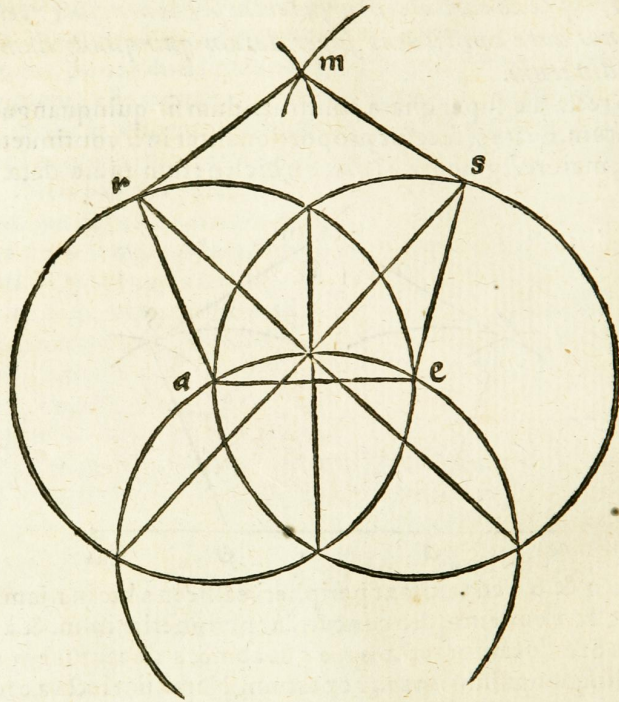
9. Si data recta secta proportionaliter continuetur utring; majori segmento, sexq; peripheria radio data concurrant, bina utring; à terminis datae & continuate, duae reliquae ab earum concursu: recta per concursus & terminos datae constituent super datam quinquangulum ordinatum.

Esto recta a e super quam construendum sit quinquangulum ordinatum. Ea itaq; secetur proportionaliter in i. continueturq; utring; majori segmento a i illic e u hic a o: tum radio datae ter-



minis e u & o, a concurrant peripheria illic in s hic in r, jam terminis s & r eodem radio concurrant peripheria in m. & à terminis a & e ducantur rectae a r, e s & ab r & s ducantur r m, s m. Erit quinquangulum a e s m r optatum. Nam cum recta a e secetur proportionaliter, & continuetur majori segmento: cōtinuata secabitur proportionaliter per c. 3. e. 14. R. & data a e erit segmentum majus. & per 8. e. latus quinquanguli. Mechanici hodie compendium fabricae habent tale: Si quinq; peripheria radio datae concurrant, duae à terminis datae, tertia ab earum concursu, reliquae à terminis rectarum è concursu tertiae cum primis per sectionem bisecantis datam infinite & tertiae in primas: recta

Et à concursu reliquarum per sua centra segmentum majus in terminos datæ constituent super datam quinquangulum ordinatum. ut hic data recta a e experiri potes.



10. Si diameter circuli quinquangulo circumscripti est rationalis : est irrationalis ad latus inscripti quinquanguli. è 11. p. 13.

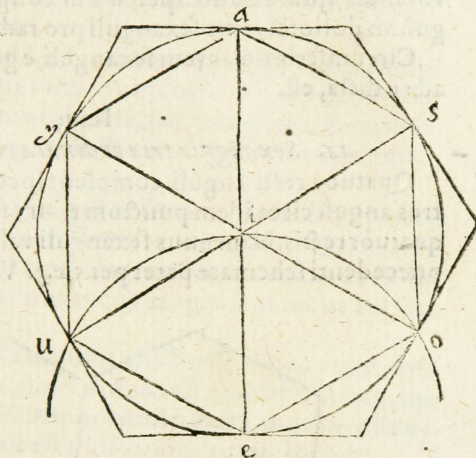
Euclides hæc ita proponit: sed addit latus quinquanguli esse minorem irrationalem: quod ad Geometriam non multum attinet.

net. pendet autem elementum inde quod segmenta rectæ proportionaliter sectæ sunt irrationalia 2. e. 14. R. Sequitur inscriptio sexanguli.

11. *Radius circuli est latus inscripti sexanguli.* 15. p. 4.

Sexangulū per 2. e. inscribi posset in scripto triangulo equilatero bisectis nēpe trib. angulis: sed brevius hoc modo p radiū inscribit, sexies repetitū.

Esto in circulo diame-
ter a e. jam centro e ra-
dio ei. Describatur pe-
ripheria u i o. & diame-
tri à punctis u & o sint
u s, o y. Hæ connexæ &
inter se & cum diame-
tro a e inscribent sexan-
gulum equilaterum da-
to circulo lateris radio
æqualis: & etiam æqui-
angulum proindeq; or-
dinatum. utrumque de-
monstrabitur hoc mo-
do: primum



Triangula æqua angulo æquicruro æquantur basibus. At hic triangula sex æquicrura sunt: Nam crura sunt radii ejusdem peripheriæ ergo æquales per 2. e. 1. ut i u, i e, & i e, i o item i o, i s & sic deinceps: & æqua angulo æquicruro. Nam cum u i & u e item e i sint radii æqualium peripheriarum ex fabrica. triangulum u i e est æquilaterum: quare u i e est $\frac{2}{3}$ recti per 3. c. 10. e. 6. R. Sed eodem argumento e i o est etiam $\frac{2}{3}$ recti proinde priori æqualis: sed his duobus æquantur illic a i s hic y i a. per 2. c. 8. e. 5. R. sed & a i s, e i o hoc est $\frac{1}{3}$ recti de duobus rectis per 1. c. 8. e. 5. R. relinquent $\frac{2}{3}$ recti pro angulo s i o hoc est pro angulo y i u. Sex anguli itaq; æquantur.

Ergo bales u e, e o, o s, s a, a y, y u sunt sex æqualia latera inscri-
n pra:

pra: æqualia radio ut in demonstratione patuit: sunt enim trian-
gula æquilatera.

Quod ad secundum attinet nempe esse sexangulum æquian-
gulum, id ex 2. e. 6. sequitur. Nam est jam demonstratum æqui-
laterum.

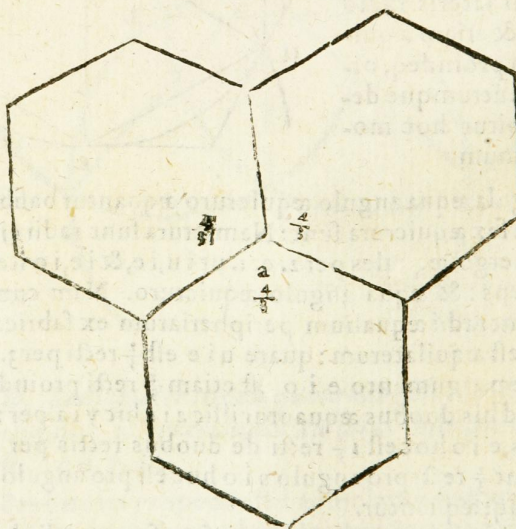
Et est elementi huius vulgaris usus apud doliarios. ii enim
volentes aptare dolio operculum congruum: inscribunt sexan-
gulum dolio: & latus sexanguli pro radio operculi retinent.

Circumscriptio autem sexanguli, è generali circumscriptione
ad 1. e. dicta, est.

Itaq;

12. *Sexangula tria ordinata complent locum.*

Quatuor recti anguli complent locum planum 16. e. 4. R. At
tres anguli circa idem punctum trium sexangulorum æquantur
quatuor rectis. Nam unus sexanguli valet $\frac{4}{3}$ hoc est $1\frac{1}{3}$ recti, ut in
præcedenti schemate patet per 5. e. 3. Vel quia duplus est exem-



pli

pli gratia angulus u eo anguli u ei qui valet $\frac{2}{3}$ recti. erit ipse $\frac{4}{3}$ recti. aut quia 6 valent 8 rectos per 4.e.6.R. valebit unus $\frac{1}{3}$. Ergo triplex erit $\frac{1}{3}$ recti hoc est 4 recti.

Ergo sexangula tria complent locum. ut hic anguli ad a complent locum.

Aristoteles in doctrina cœli 8.c. 3. ordinatas figuras in planis tres locum complere ait: triangulum, quadratum, sexangulum. De triangulo constare 4.c.10.e.6.R.

Quod ad quadratum attinet: speciatim nos $\tau\epsilon\lambda\epsilon\gamma\omega\nu\epsilon\upsilon$ Aristotelis intelligere non est opus nisi synecdochicè pro rectangulo quolibet accipiatur. Nam quatuor rectangula quælibet tanquam complent locum 2.c.2.e.11.R. De sexangulo ex hoc elementis patuit.

Nec præter has est in planis figura ulla quæ locum compleat. Nam quinquanguli angulus est $\frac{1}{2}$ recti per 4.e.6.R. Quare triplex erit $\frac{3}{2}$ recti: quadruplex $4\frac{1}{2}$. Atque ut illic quantitas necessaria deficit: sic hic redundat multoque magis si quinque aut sex quinquangula assumantur.

Eodem modo septanguli angulus est $\frac{1}{3}$ recti. Nam 7 æquales æquantur 10 rectis. Ergo æqualium unus est $\frac{1}{3}$ recti. Est itaque duplex $2\frac{2}{3}$ recti triplex $4\frac{2}{3}$ illic minor hic major. ita angulus octanguli est $\frac{1}{4}$ recti. Ergo duplex est 3 rectorum: sed triplex $4\frac{1}{4}$.

Et sic deinceps inducenti constare poterit tribus tantum planis compleri locum ordinatis triangulo & sexangulo ordinato: rectangulo quolibet.

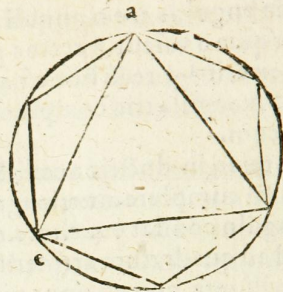
Et

13. Si recte ab uno inscripti sexanguli angulo in tertium utrinque angulum connectantur: inscribentur triangulum æquilaterum dato circulo.

Hoc Theon è sua demonstratione deducit. Sit enim inscriptum sexangulum. jamque ab uno angulo sexanguli ad a in tertium utrinque angulum e & i inscribantur rectæ a e, a i & connectantur: inscribentur triangulum a e i æquilaterum. Nam latera

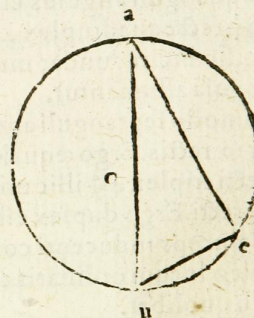
n 2 subten-

subtenduntur peripheriis æqualibus a e, a i, e i. ergo per 14. e. 2. latera sunt æqualia. Et est hoc tantum hic speciale de connexionione duarum inscriptarum. At latus ab uno inscripti angulo in tertium esse latus inscripti ordinati dimidii numero laterum 2. e. docebit.



14. *Latus inscripti trianguli potest triplum circularis radii. 12. p. 13.*

Esto latus inscripti trianguli æquilateri a e. dico id posse triplum radii o u. Nam a e subtendit duas tertias semiperipheriæ: & reliquam tertiam hoc est peripheriæ totius sextā secat recta e u. Quare e u per 11. e. est latus sexanguli vel radius. Hinc ita colligitur. latus trianguli & sexanguli a e, e u æque possunt basi, hoc est diametro a u per 5. e. 12. R. cum angulus ad e rectus sit per 4. e. 4.



At diameter potest quadruplum dimidii nempe radii o u, hoc est e u, per 7. e. 12. R.

Ergo latus trianguli & sexanguli possunt quadruplum lateris sexanguli: ablato itaq; e u latere sexanguli remanebit potentia a e ad e u potentiam tripla.

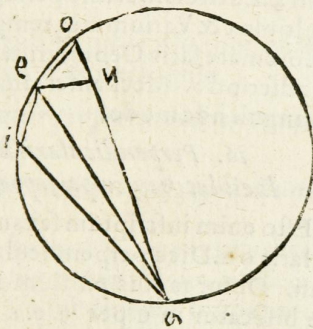
Hinc infinita fere specialia theorematum pro inventione lateris trianguli extiterunt. Et sane Ptolemæus hinc latus trianguli inscripti investigat: si potentia radii triplicetur: triplicatq; latus est latus inscripti trianguli. ut si sit radius 10,000,000. ejus potentia triplicata est 300,000,000,000,000. cuius la-

tus

rus est 17, 320, 508 ferè. pro latere trianguli inscripti. Alii adhibent methodum generalem 6. aut 11. e. 4. alij aliter speciale theorema hoc fecerunt. Exempli gratia: trium quartarum quadrati diametri latus est trianguli æquilateri inscripti latus. Quod eodem recidit. Sed quia in thesauris sexanguli atq; trianguli versamur nec hoc $\mu\upsilon\sigma\theta\eta\kappa\iota\omicron\upsilon$ occlusum relinquemus.

15. Si à termino lateris trianguli æquilateri inscripti duæ rectæ in puncta peripheriæ equaliter à reliquo dicti lateris termino remota inscribantur: differentia inscriptarum æquatur inscriptæ inter reliquum terminum & alterutram inscriptam.

Est in adjuncta figura latus trianguli æquilateri inscripti: sintq; à termino a inscriptæ duæ quæ cadant in puncta i & o æqualiter remota ab altero termino e. Sitq; a i æqualis a u erit ergo u o differentia inscriptarum. Dico eam esse æqualem inscriptæ e o vel e i. Nam completè inscripto triangulo: angulus in sectione e o a erit $\frac{2}{3}$ recti. Sed e i supra eadem basi e a æquatur angulus e o a per 15. e. 3. Sed & angulo e o u æqualis est angulus e u o per 10. e. 6. R. Nam anguli i a e, e a u æquantur & æquicruri sunt ex fabrica. Ergo per 2. e. 7. R. e u æquatur ipsi i e: hoc est ex thesi & 14. e. 2. e o. Quare e o & e u subtendent angulos æquales jam $\frac{2}{3}$ & $\frac{2}{3}$ recti de duobus rectis relinquunt $\frac{1}{3}$ pro angulo o e u. Ergo & angulus o e u, æquatur angulo o u e. proinde per 10. e. 6. R. o e & o u æquantur. Atq; ita patet veritas. poterit vero transferri elementum etiam ad sinus per 10. e. 5. & ita quidem enunciari: *Differentia sinuum peripheriarum à sextante totius peripheriæ æquali differentia majoris & minoris æquatur sinui differen*
n 3 tiæ.

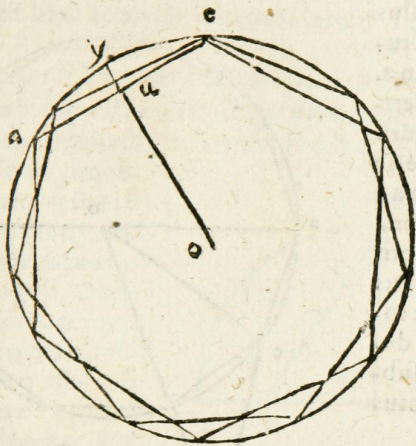


tiæ. Confectarium certe pro constructione canonis sinuum nobilissimum. Atque ita sexanguli & adjuncti trianguli inscriptio fuit. Figura verò sexangula vulgo Geometria apud vocatur. Apis enim, ait alicubi Varro, sexangulam cellam sibi architectatur, quot habet ipsa pedes: quod Geometræ $\xi\gamma\alpha\nu\omega\nu$ fieri in orbe rotundo ostendunt: ut plurimum loci includatur. Hoc idem Pappo in Proœmio libri quinti copiosius demonstratur. Et ita adscriptionem habemus trianguli, quadrati, quinqueanguli, sexanguli, octanguli. jam ad septangulum & nonangulum opus esset triangulo, cujus uterq; angulus ad basin esset illic triplus hic quadruplus reliqui. in hujus inventione multum posuisse operæ atq; studii Geometras veteres accepimus. Quidam, ait Proclus, ab Archimedis helicibus incitati in datam rationem datum angulum rectilineum secuerunt. Conatus illos Geometricos P. Ramus scholis suis Mathematicis inseruit lib. 12. in 4. Euclidis. qui illic perlegi possunt: artificium est difficile, multiplex & Varium: nec temporum proportio in Archimedeo theoremate satis Geometrica videtur: Et refutata à Nonio hæc est adscriptio. Mechanici tamen septangulum inscribunt opera sexanguli hoc modo.

16. *Perpendicularis à centro in latus inscripti sexanguli, est latus inscripti septanguli.*

Esto enim inscriptum sexangulum: & à centro o sit perpendicularis o u. Dico perpendicularem o u esse latus inscripti septanguli. Detur radius partium 10 totidem erit latus a e. jam quia a e bisecatur in u per 19. e. i. erit e u partium 5. & proinde u o erit $8\frac{1}{7}$. Quare u y erit $1\frac{6}{7}$. jam sex perpendiculares sunt æquales pro sex lateribus: pro septimo sunt segmenta radiorum sex inter latera sexanguli & peripheriam: quæ æquantur uni è perpendicularibus dictis. Nam segmentum unum est $1\frac{6}{7}$. ergo sex restituant ferè unam perpendicularem.

Atq;



Atq; hæc Mechanicorum septanguli est inscriptio: per quam etiam circumscriptio est ex 1 e. Sequitur de decangulo.

17. Si latus sexanguli secetur proportionaliter: majus segmentum erit latus decanguli.

Est Pappi lib. 5. theor. 24. & habet Campanus ad 3. p. 14. Commandinus ad 9. p. 13.

Secetur enim radius a o seu latus sexanguli proportionaliter per 3. e. 14. R. & sit a e æqualis majori segmento. Dico a e esse latus decanguli. Est enim peripheria a e subdecupla totius peripheriæ. Ergo & inscripta ejus est latus decanguli.

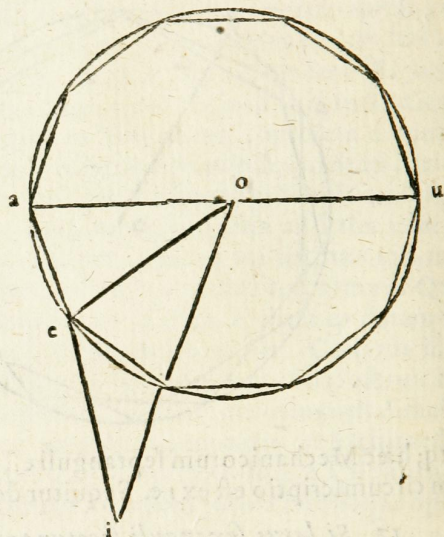
Hujus πρόθεσις hæc est. A centro o in terminum e ducatur radius: fiet triangulum æquicrurum a o e cujus anguli ad a & e per 10. e. 6. æquantur: & uterque duplus est anguli a o e per 7. e. Nam a o ex thesi secatur proportionaliter & a e & majus segmentum.

Ergo angulus a & e simul est quadruplus anguli o.

At angulis o a e, a e o æquatur angulus e o u per 2. c. 9. e. 6. R.

Quare

Quare & angulus
e o u est quadru-
plus anguli e o a.
& per 5. e. 3. peri-
pheria u e quadru-
pla est peripheriæ
a e. jam addita a e
ad e u semiperi-
pheria circuli erit
quintupla ipsius
a e, & proinde to-
ta peripheria de-
cupla. Quare sub-
tensa a e est latus
decanguli.



Itaq;

18. Si decangulum & sexangulum eidem circulo inscri-
bantur: recta e latere utriusq; continuata secabitur propor-
tionaliter, & majus segmentum erit latus sexanguli: & si
majus segmentum recta proportionaliter secta est latus
sexanguli: reliquum erit latus decanguli. 9. p. 13.

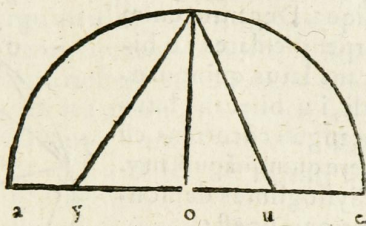
ut in præmissa figura a e sit latus decanguli inscripti, e i verò
radius hoc est latus sexanguli. dico rectam a i secari propor-
tionaliter in e. Nam per 17. e. a e est majus segmentum rectæ e i se-
ctæ proportionaliter. est enim ex thesi latus decanguli: & conti-
nuatur recta e i majori segmento. Ergo per c. 3. e. 14. tota conti-
nuata secabitur proportionaliter in e. & majus segmentum erit
data e i latus nēpe sexanguli. unde etiā consequitur fore ut a e sit
latus

latus decanguli si ei sit latus sexanguli & tota a i secta proportionaliter. Et hinc sequitur inventio lateris decanguli Prolemaica.

Et

19. *Latus simul utriusq. quadrati radii & semiradii, minus semiradio est latus inscripti decanguli.*

Sint in dato circulo diametri inter se rectæ a e, & i o. bisecetur radius o e in u connectaturq; i u. atq; rectæ i u æqualis ponatur u y. Dico jam o y esse latus inscripti decanguli. Nam recta e y est secta proportionaliter in o & segmentum majus eo est latus sexanguli, quia ex thesi est radius. ideo per 18. e.



y o erit latus decanguli. Quod autem sectio proportionalis sit ad o hinc patet. Quia enim o e est bisecta & continuata per 7. e. 13. R. oblongum e y. y o cum quadrato o u æquatur quadrato y u hoc est ex fabrica i u.

At quadratum i u æquatur quadratis i o, o u. Quare oblongum e y. y o cum quadrato o u æquatur quadratis i o, o u & ablato quadrato communi o u. oblongum e y. y o æquabitur quadrato i o hoc est ex thesi o e. itaq; per 4. e. 12. R. ut e y ad o e sic o e ad y o. & proinde per 1. e. 14. R. recta e y est secta proportionaliter in o. Quare patet y o esse latus decanguli. jam quia datur radius i o & semiradius o u dabitur per 5. e. 12. R. recta i u nempe basis trianguli rectanguli. Sed i u æqualis ex thesi est y u. Ergo inde sublato u o semiradio relinquetur o y latus decanguli.

ut si detur radius 10,000,000. erit ejus potentia

100,000,000,000,000

& potentia semiradii

25,000,000,000,000

125,000,000,000,000

Hujus latus tetragonum est

11,180,

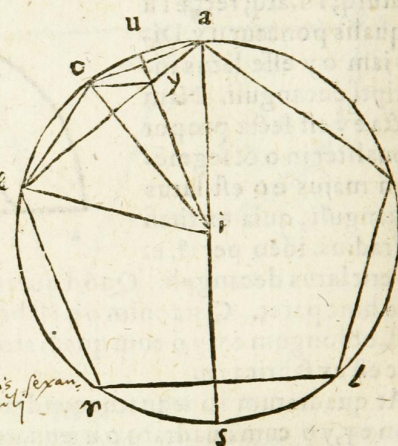
11, 180, 340. inde ablati semiradius relinquit 6, 180, 340. pro latere inscripti decanguli.

20. Si decangulum, sexangulum & quinquangulum eidem circulo inscribantur: latus quinquanguli potest latera reliquorum: & si recta potest latera sexanguli & decanguli: est latus quinquanguli. 10. p. 13.

Esto latus inscripti quinquanguli $a e$, sexanguli $e i$, decanguli $a o$. Dico jam posse reliqua. Ducantur enim perpendiculares $i o$ bisecans latus quinquanguli, $i u$ bisecans latus decanguli concurrens cum latere quinquanguli in y .

Syllogismus demonstrationis sic est:

Oblonga est latere quinquanguli & ejus segmentis $a e$, $e y$ & $e a$, $a y$ æquantur quadratis reliquorum laterum illius $e i$ hic $a o$.



At quadratum lateris quinquanguli æquatur oblongis est toto & segmentis per 3. e. 13. R. ^{oblonga est tota & segmentis æquantur}

Ergo quadratum lateris quinquanguli æquatur quadratis lateris sexanguli & decanguli.

Assumptio dubia non est: propositio est. Ejus igitur prosyllogismus attendatur.

Bis bina triacula $a e i$, $y e i$ & $a o e$, $a o y$ sunt æquiangulara.

Ergo per 9. e. 7. R. figillatim bina cruribus sunt proportionalia. eritq; illic

ut $a e$ ad $e i$ sic $e i$ ad $e y$

hic verò

ut $e a$ ad $a o$ sic $a o$ ad $a y$.

Et

Et per 4. e. 12. R. illic oblongum a e, y quadrato ei hic oblongum e a, y quadrato a o æquale existit. Et ita syllogismi constat propositio. Sed & pro syllogismi antecedens hoc modo demonstratur. & primo quod triangula a e i, y e i sint æquiangula. Nam angulus ad e communis est: & angulus e i y, angulo e a i æquatur.

Nam ejusdem dimidia æquantur ex Arithmetico axioma.

Anguli e i y, e a i sunt anguli e i s dimidii.

Nam primo angulus e i s æquatur angulis i e a, i a e per 2. c. 9. e.

6. R. æqualibus per 10. e. 6. R. Ergo alterius e a i est duplus.

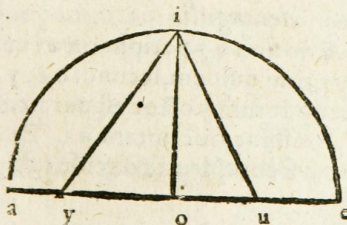
Secundo peripheria s r e est peripheriæ e o u dupla. Nam semiperipheria a l s æquatur semiperipheriæ a r s. item a l ipsa r. Ergo l s æquatur reliquæ r s. sed his etiam æquatur e o. per 1. e. Quare r l hoc est r dupla est ipsius r s hoc est e o. & r s dupla ipsius o u. nam ex thesi o a hoc est e o id est r s bisecatur in u. Quare tota s r e dupla est peripheriæ e o u.

Itaque per 5 e 3. angulus e i s duplus est anguli e i y. jam cum in triangulis a e i & y e i bini æquentur anguli per c. 3. e. 7. R. erunt æquiangula.

Secundo triangula quoque a o e, a o y esse æquiangula patet. communis enim angulus ad a est. & angulus a o y æqualis est angulo a e o. Nam eidem æquantur nempe angulo o a y illic per 2. e. 7. R. hic per 10. e. 6. R. illic enim perpendicularis i u bisecans a o facit triangula duo o u y, y u a æqua angulo ad u recto æquicrura. quare æquilatera & æquiangula: hic vero e o, o a per 10. e. 6. R. subtendunt angulos æquales. Cum itaque bini anguli sint æquales triangula a o e, a o y erunt æquiangula per c. 3. e. 7. R. Atque ita constat & demonstrationis propositio, propositionisq; prosyllogismus.

Conversa Euclides adhibet in demonstratione inscriptionis Icosaedri in sphaera 16. p. 13. Et Ptol. 9. c. 1. inde latus quinquaguli investigat hoc modo.

Repetita figura 19. e. patuit



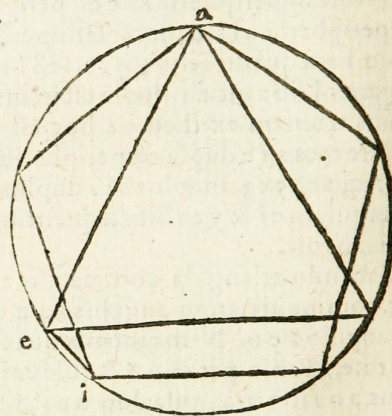
o 2 y o

y o esse latus decanguli: & i o est latus sexanguli. Quia jam hæc, inquit, potest per 5. e. 12. R. recta i y: ea erit latus quinquanguli. ideoque notis y o & i o facile dabitur i y. Sit enim y o partium 6,180,340. & i o partium 10,000,000. erit i y latus quinquanguli partium 11,755,704 ferè.

21. Si triangulum & quinquangulum eidem circulo inscribantur ad idem punctum: recta inscripta inter utriusq; basin dicto puncto oppositam erit latus inscripti quindecanguli. 16.p.4.

Inscribantur enim a puncto a. eidem circulo triangulum & quinquangulum: & inter utriusq; basin puncto dicto oppositam sit inscripta ei. dico eam esse latus quindecanguli. Est enim peripheria a i $\frac{1}{15}$ totius.

Nam peripheria a e est $\frac{3}{5}$ totius & a i sunt $\frac{2}{5}$ totius. jam si tollas $\frac{1}{5}$ de $\frac{2}{5}$ relinquetur $\frac{1}{5}$ totius peripheriæ. Et hinc patet inventio lateris quindecanguli ista.

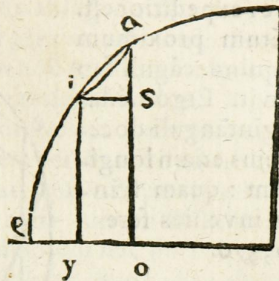


Itaq;

22. Differentia sinuum sexta ac decime peripheriæ partibus primorum & secundorum possunt inscriptam quindecanguli.

Esto sit a e $\frac{1}{6}$ peripheriæ e i vero $\frac{1}{10}$: sintque horum sinus a o, i y primi quidem, secundi o e, y e. sitq; differentia primorum a s. secundorum y o hoc est per 2. c. 6. e. 10. R. i s. jam per 5. e. 12. R. i s & s a possunt inscriptam a i. Ea autem est latus quindecanguli. Nam si compleatur circulus, dupla a e erit $\frac{1}{3}$ dupla i e $\frac{1}{5}$ peripheriæ

riae & i y, a o dupla per 19. e. i. fient latera trianguli & quinquanguli & quidē bases in-
scriptorum ab eodem puncto. Ergo per 21. a i erit latus quindecanguli. Hinc jam patet inventio ejus. Nam latus trianguli inventum est ergo & semissis nempe a o dabitur pro sinu sextae partis



At lateris quinquangu-

li semissis 8,660,254.
5,877,852.
Ergo a s erit 2,782,402.

Atque cum dentur arcuum a e, i e sinus primi: dabuntur etiam sinus complementorum per 9. e. 5 illic 5,000,000 hic 8,090,170.

Et per 17 e 5 sinus secundus o e 5,000,000
Et e y 1,909,830

Itaq; y o vel i s 3,090,170.

Quare per 5. e. 12. R. inscripta a i hoc est latus quindecanguli erit partium 4,158,234 fere.

Et

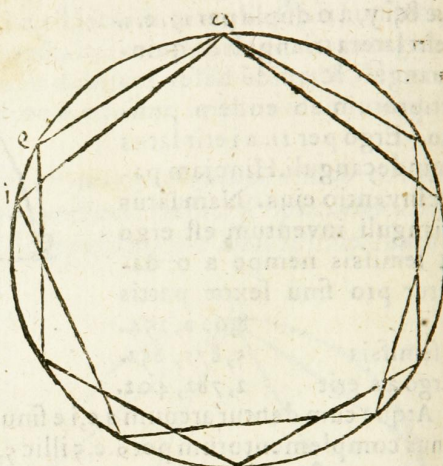
23. Si quinquangulum & sexangulum eidem circulo inscribantur ad idem punctum: peripheria inter utriusq; latera erit pars tricesima totius peripheriae.

Hæc est inscriptio quindecanguli duplicati, hoc est triangulati ordinati cujus anguli sunt 30. itaque & sexangulo utitur, duplicato scilicet triangulo. inscribatur ad idem punctum a sexangulum & quinquangulum. Sitque peripheria e i inter ipsorum latera. dico eam esse $\frac{1}{30}$ peripheriæ totius. Nam a e $\frac{1}{6}$ de a i $\frac{1}{5}$ relinquit ei $\frac{1}{30}$.

Quare hinc patet inscriptio trigintanguli. Nam inscripta e i est latus.

Generalis tamen duplicati ordinati multanguli inscriptio
o 3 per

per 2. e. expeditior est.
Elemētum proximum
latus quindecāguli sup-
peditavit. Ergo 2. e. la-
tus trigintanguli doce-
bit. & ejus etiam longi-
tudinē : quam si in-
quiras invenies fere
2,090,570.



TH. FINKII GEOME-
TRIAE ROTVNDI,
LIBER OCTAVVS.

De tetragonismo circuli.



Geometria circularis conjuncta: & adscriptio rectili-
nei & circuli geodæsiā nobis subministravit mult-
anguli ordinati 4. e. 6. Eadem geodæsiā ac dimen-
sionem circuli concedet. Dimensio isthæc tetrago-
nismus & vulgo quadratura circuli dicitur. Argu-
mentum certē mathematicum nobilibus omnium ætatum ani-
mis tanquam perpetuum exercitium propositum. Brissonis qua-
dratura ab Aristotele citatur primo poster. & Elench. ubi legi po-
terit: additis Alexandri commentariis, quibus summa demon-
strationis Brissonicæ repetitur. Verum ut hic parum profecit: ita
& Aristoteli parum effecisse Antipho visus est: imo 2. c. 1. physi-
corum gravis ejus paralogismus notatur: & veluti responsione
Geometrica

Geometrica indignus à philosopho ablegatur. Quare in arenam hanc cum descenderint & veteres plurimi è recentioribus etiam non pauciores: maxime negotium hoc Archimedes promovisse videtur. Nodus quæstionis est in ratione diametri & peripheriæ. Eam Archimedes talem demonstravit: qualis etiamnum hodie in geodæsia retinetur. Rationem certè ascribibilem nō arbitror: cum ratio curvi ad rectum sæpe dari possit: & peripheria in planū motu suo extendi possit: ut in rotis currum observare licet. Et si vero in peripheria non sit principium nec finis: hypotheticum tamen principium ejus dari, & hypothetico fine claudi non est dubium. Sed rationem Archimedeam doceamus.

1. *Peripheria est tripla diametri & fere sesquiseptima.*

Demonstrat Archimedes habere peripheriam ad diametrum rationem minorem tripla sesquiseptima, majorem tamen tripla superdecupartiente septuagesimas primas. Sed quia excessus vicinior erat sesquiseptimæ quam sesquioctavæ, ideo sesquiseptima retenta fuit: pro ipso vero, quod vero erat propinquum.

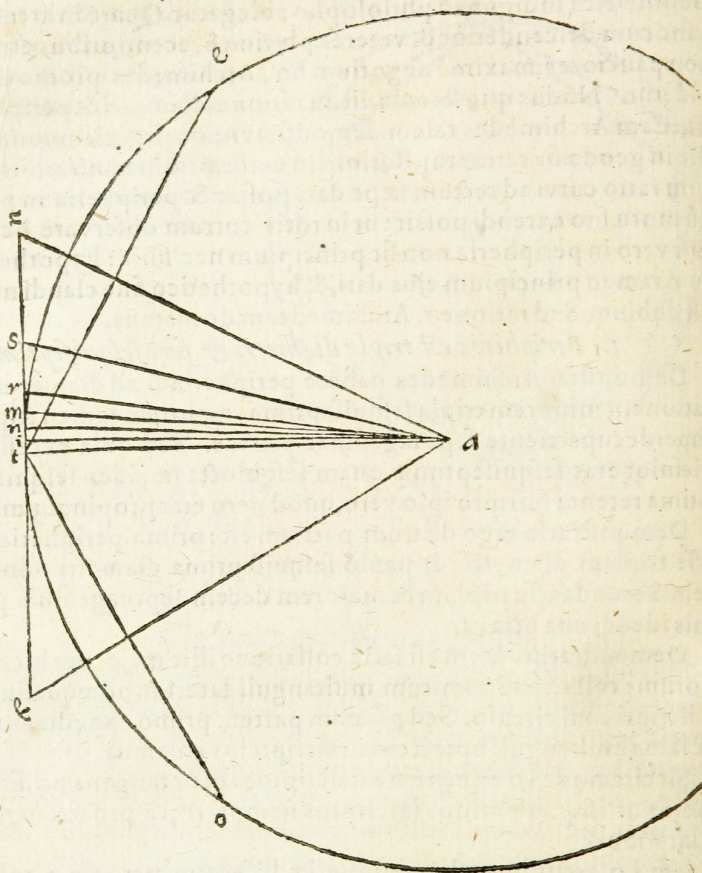
Demonstratio ergo duarum partium est: prima peripheriam esse triplam diametri, & paulo sesquiseptima diametri minorem: Secunda esse triplam & majorem decem septuagesimis primis ideoq; una octava.

Demonstratio autem est facta collatione illic majorum hic minorum: collatione nimirum multanguli laterum 96 æqualium adscripti cum circulo. Sed primam partem primò expediamus. ac latus multanguli optati circumscripti inveniamus.

Sic circulus e i o ex centro a descriptus: & sit tangens u y. sitq; radius utring; à termino i inscriptus nempe i o, i e pro sexanguli lateribus.

jam i o arcus hoc est $\frac{1}{6}$ peripheriæ bisecetur per 13. e. 3. recta a y. erit ergo per 5. e. 3. angulus i a y $\frac{1}{12}$ totius peripheriæ hoc est $\frac{1}{12}$ anguli recti. Nam $\frac{1}{12}$ quatuor rectorum est $\frac{1}{3}$ unius recti. jam ponatur i u æqualis rectæ i y & connectatur a u. erunt duo triangula u a i. i a y æqua angulo ad i æquicruo. Ergo & æqua basibus a y, a u. itaq; & æquiangula per 1. e. 7. R.

Quare



Quare angulus u a y erit $\frac{1}{2}$ recti. Nam uterque particulatim æquatur sibi: & unus ex thesi est $\frac{1}{2}$.

Sed & anguli a u i, a y i æquantur. Est autem alteruter $\frac{1}{2}$ recti nempe sublato angulo i a y $\frac{1}{2}$ de recto uno. Est itaq; triangulum u a y

uay æquilaterum: & proinde au erit duplum ad ui. Quare si ui sit 153, bifecans a u valebit 306. jam si quadratum perpendicularis ui 23, 409 de quadrato secantis a u 93, 636 subduxeris: restabit quadratum radii ai per 5. e. 12. R. 70, 227. Cujus latus erit 265 ac paulo plus, id sic deinceps notetur 265+. Quare ex axioma arithmetico quod est 8 p 5 Euclid. ratio radii ai ad tangentem ui sit major quam 265 ad 153. Hoc ergo triangulum ai u lateribus suis ita dimensum fundamentum est multiplicis sectionis anguli u ai. & laterum in factis hinc triangulis inventionis. primum itaq; angulus subtertius recti u ai bifecetur per 6. e. 5. R. recta a s: & fiet angulus s ai $\frac{1}{2}$ recti. itaq; per 12. e. 6. R.

ut a u ad ai sic u s ad si.

& per additionem proportionum

ut au & us

ai ad ai sic si ad si

Et alterne

ut au & us &

ai ad si sic ai ad si.

Quare ratio simul utriusque cruris a u & ai 306 & 265+ id est 571+ ad 153 erit etiam ratio ai ad conterminum segmentum si: major nempe ratione 571 ad 153. ut si segmentum si valeat 153 radius valebit plus quam 571.

Et sic in triangulo ai s crura recti sunt mensa. ubi numerus segmenti i s est qui fuit totius i u. quod etiam deinceps servabitur. jam vero quadratum i s sit 23, 409. at quadratum ai 326, 041. totum 349, 450+ erit per 5. e. 12. R. pro secunda bifecante nempe a s. latus vero erit $591\frac{1}{8}+$.

Et hæc fuit prima divisio anguli tertiarii, sequitur secunda. Bifecetur itaq; angulus s ai: erit proinde r ai $\frac{1}{2}$ recti, nempe dimidius dimidii unius tertiæ unius recti $\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$ hoc est $\frac{1}{4}$. Erit itaq; rursus

ut a s ad ai sic r ad ri. Et

ut a s & ai ad s r & ri. sic ai ad ri.

Quare ratio simul utriusque cruris a s, ai $591\frac{1}{8}+$ & 571+ hoc
p est

est $1,162\frac{1}{8} +$ ad 153 ; erit etiam ratio $a i$ ad conterminum segmentum $r i$: maior nempe ratione $1,162\frac{1}{8}$ ad 153 . Fiant jam quadrata radii $1,162\frac{1}{8}$ & contermini segmenti $r i$ erunt $1,350,534\frac{3}{4}$ & $23,409$ totum aut per $5.e.12.R.$ pro bisecante $a r$ & ipsa $a r$ $1,172\frac{1}{8} +$.

Atque hæc secunda anguli fuit bisectio: triangulumq; tertium lateribus dimensum. Sequitur tertia bisectio anguli scilicet $r a i$. Fiat itaq; angulus $m a i$ $\frac{1}{2} \frac{1}{4}$ unius recti. est enim $\frac{1}{2} \frac{1}{2} \frac{1}{2} \frac{1}{2}$ hoc est $\frac{1}{2} \frac{1}{4}$. erit ergo per præmissas ratiocinationes ratio simul utriusq; cruris $a r, a i$ $1,172\frac{1}{8} +$ & $1,162\frac{1}{8} +$ hoc est $2,334\frac{1}{4} +$ ad 153 . Eademque $a i$ ad $i m$ maior nempe ratione $2,334\frac{1}{4}$ ad 153 . jam adde quadrata crurum $5,448,723\frac{1}{6}$ & $23,409$: totum erit pro quadrato $a m$. & latus $2,339\frac{1}{4} +$ pro latere $a m$.

Atq; hæc fuit tertia bisectio, quarti q; trianguli laterum dimensio. & hic habemus $\frac{1}{9} \frac{1}{6}$ totius peripheriæ. Nam $u a i$ fuit $\frac{1}{1} \frac{1}{2}$. Ergo $\frac{1}{2} \frac{1}{2} \frac{1}{2} \frac{1}{2} \frac{1}{2}$ erit $\frac{1}{9} \frac{1}{6}$.

Sed ratio totius diametri ad segmentum tangentis non succederet. itaq; angulus æqualis jam inventus aliter inveniendus est, addendo æqualem ad inventi dimidium.

Quare sequatur jam quarta bisectio anguli nempe $m a i$ per rectam $a n$. Erit ergo $n a i$ $\frac{1}{4} \frac{1}{8}$ unius recti nempe $\frac{1}{2} \frac{1}{2} \frac{1}{2} \frac{1}{2} \frac{1}{2}$ hoc est $\frac{1}{4} \frac{1}{8}$.

Hic jam ratio per præcedentes ratiocinationes $a i$ ad $i n$, est ratio utriusque cruris $m a$ & $a i$ hoc est $2,339\frac{1}{4} +$ & $2,334\frac{1}{4} +$ id est $4,673\frac{1}{2} +$ ad 153 . Atq; hæc anguli sectio quintuplex fuit.

jam ponatur angulus $n a i$ æqualis angulus $i a r$: Erit ergo angulus $n a r$ æqualis angulo $m a i$ hoc est $\frac{1}{9} \frac{1}{6}$ totius peripheriæ, ut paulo ante patuit. $n r$ itaq; erit latus multanguli laterum 96 circumscribendi: quod nonagies sexies deinceps paribus interval-
lis circa peripheriam circumscriptum totam figuram complebit.

Hiscæ fabricis bisectionis angulorum & triangulorum dimensionibus absolutis ratio proposita sic colligitur.

Radius $a i$ ad segmentum $i n$ majorem rationem habet quam $4,673\frac{1}{2}$ ad 153 . ut jam innuitur.

At ut radius $a d$ in sic diameter $a d n r$. Est enim diameter du-
pla

pla radii & n t dupla i n: & partea multiplis sunt proportionales.

Tota igitur diameter ad n t maiorem habet rationem quam 4,673 $\frac{1}{2}$ ad 153. At si 153 per 96 multiplices facies perimetrum circumscripti multanguli 14,688. jam ratio perimetri multanguli ad diametrum est tripla major 667 $\frac{1}{2}$ ipsius diametri: quemadmodum ex arithmetica rationum investigatione patet. Vel sic: à perimetro ter tollas 4,673 restabunt 669. inde rursus $\frac{1}{2}$ ter ablata relinquit 667 $\frac{1}{2}$ ipsius diametri. At hæc minor est quam septima pars diametri. Nam septies 667 $\frac{1}{2}$ sunt 4,672 $\frac{1}{2}$. numerus unitate scilicet minor quam diameter. Ergo perimeter multanguli laterum 96 circumscripti tripla est diametri circularis, sed paulo minor sesquiseptima, unitate nimirum unius septimæ. Quare & peripheria tripla quidem diametri est, sed multo minor sesquiseptima. Est enim contenta peripheria inscripti circuli. Ergo continente perimetro nona sexanguli circumscripti minor.

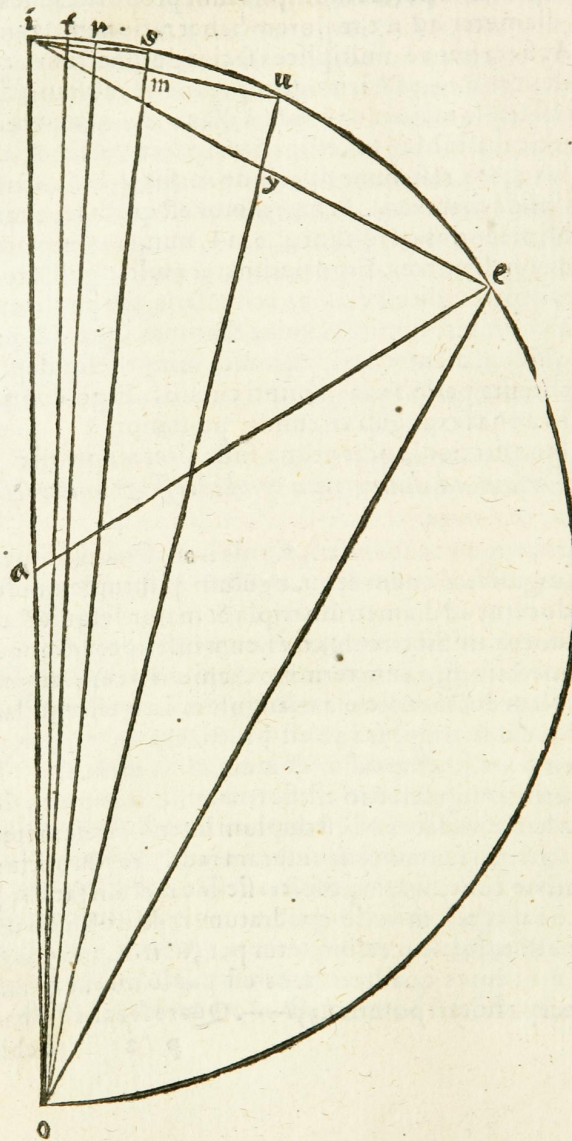
Atq; hæc demonstrationis pars prima fuit: altera superest:

Peripheriam ad diametrum triplam esse & multo sesquioctava maiorem.

Fabrica est hic primo ut ante inscriptionis nona sexanguli per quintuplicem anguli sectionem & triangulum quintuplex. inde ratio inscripti docetur ad diametrum tripla & major sesquioctava. Sed fabrica doceatur. Sit circulus o e i. cum inscripto sexanguli latere i e. connectaturq; e cum termino diametri o: erit angulus i o e $\frac{1}{3}$ recti. Nam ducto radio e a triangulum i a e est æquilateralū, & per 3. c. 10. e. 6. R. angulus i a e est $\frac{2}{3}$ recti. Quare per 9. e. 3. angulus i o e erit $\frac{1}{3}$ recti: nempe dimidius anguli in centro.

Atq; hæc ut prima anguli sectio est: sic triangulum e i o est primum in fabrica hac. Ejus latus o i est duplum lateris e i diameter nempe sui radii. itaq; si sumamus mensuram radii 780 (Orontius ut ante tangentis e i mensuram posuit 11 sic hic radium facit 15) erit diameter o i 1,560. jam tolle quadratum radii 608,400 de quadrato diametri 2,433,600. relinquetur per 5. e. 12. R. 1,825,200 pro quadrato e o: cujus quadrati latus est paulo minus quam 1,351. id sic deinceps notari poterit 1,351. Quare secans e o ha-

P 2 bebit



bebit

bebit minorem rationem ad i e quam 1,351 ad 780. Atq; sic primi trianguli latera dimensa sunt.

Sequitur quadruplex subbisectionis anguli i o e. Bifecetur itaque recta o u. & connectatur i & u. fient triangula o e y, o u i æquiangula. Nam anguli ad u & e sunt æquales per 15. e. 3: angulus etiam i o u æquatur angulo u o e ex fabrica. Ergo per c. 3. e. 7. R. reliquus reliquo erit æqualis. Quare per 9. e. 7. R.

ut o e ad e y sic u o ad u i.

At ut i o ad i y sic o e ad e y per 12. e. 6. R.

Ergo ut i o ad i y sic u o ad u i.

Et quia est ut e o ad o i sic e y ad y i: erit per compositionem proportionum.

ut e o & e y &

o i ad o i sic y i ad y i.

itaq; alterne

ut o i ad y i sic e o & o i ad e y, & y i hoc est e i.

Sed ut o i ad i y sic u o ad u i.

Ergo ratio u o ad u i est ratio e o & o i ad e i.

Hic enim numerus perpendicularis manet, qui postea si non ratione terminis tamen rationis variatur.

Addantur itaq; e o, & o i hoc est 1,351 — & 1,560. totū 2,911 — erit o u. Quare minor ratio est u o ad u i quam 2,911 ad 780. jam addantur quadratum u o 8,473,921 — & quadratū u i 608,400: totum per 5. e. 12. R. erit quadratum diametri i o. totiusque latus erit $3,013\frac{4}{8}$; hoc est $3,013\frac{3}{4}$ — Quare diameter o i ad u i minorem habet rationem quam $3,013\frac{3}{4}$ ad 780.

Atq; sic prima fuit bisectionis anguli & secūdi trianguli dimensio.

Secundo itaq; bifecetur angulus i o u recta i s. erit ergo angulus i o s $\frac{1}{2}$ recti unius nempe $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ hoc est $\frac{1}{4}$. jam connectatur recta o s secans, cum termino i.

Quia igitur per præmissum ratiocinium triangula m u o, i s o sunt æquiangula: erit

ut o u ad u m sic o s ad s i.

At ut i o ad i m sic o u ad u m per 12. e. 6. R. & alternatis terminis.

Ergo ut i o ad i m sic o s ad s i.

p 3 Et

Et hinc ut ante concludetur per compositionem proportionum esse $s o$ ad $s i$ ut $u o$ & $o i$ hoc est $2,911$ — & $3,013\frac{1}{4}$ id est $5,924\frac{3}{4}$ ad $s i$ 780 . Reducatur jam uterque terminus ad integra proportionalia, multiplicatione nempe per 4 : habebuntur integri $23,699$ — & $3,120$: rursusq; integri reducuntur per maximam mensuram communem 13 ad minores proportionales $1,823$ — & 240 hoc est ratio $s o$ & $s i$ minor est ratione $1,823$ ad 240 .

jam addantur quadrata reductorum $3,323,329$ — & $57,600$. totum erit pro diametro $o i$ $3,380,929$. totiusq; latus erit $1,838\frac{2}{3}\frac{6}{7}\frac{5}{7}$. Quare diameter $o i$ ad $s i$ minoris est rationis quam $1,838\frac{2}{3}$ ad 240 . Et hæc secunda fuit bisectionis & tertii trianguli dimensio.

Tertio biseceatur angulus $s o i$ per rectam $o r$. Triangula erunt ut ante æquiangula. ratio $o r$ ad $r i$ connectentem, erit ratio $o i$ diametri & $s o$ hoc est $1,823$ — & $1,838\frac{2}{3}$ — id est $3,661\frac{2}{3}$ — ad 240 . Reducito hic partes ad integra proportionalia multiplicatione per 11 facies $40,280$ & $2,640$ hoc est facta divisione per communem mensuram maximam $1,007$ — ad 66 . Horum jam quadratis $1,014,049$ — & $4,356$ additis, totum erit quadratum diametri, diameterque ipsa $1,009\frac{1}{6}$ — Quare $i o$ ad $r i$ est rationis minoris quam $1,009\frac{1}{6}$ ad 66 .

Hæc tertia erat bisectionis ubi angulus $r o i$ est $\frac{1}{4}$ recti: nempe $\frac{1}{2} \frac{1}{2} \frac{1}{2} \frac{1}{2}$ hoc est $\frac{1}{2} \frac{1}{4}$: Et dimensio fuit trianguli quarti.

Quarto jam biseceatur angulus $r o i$ per rectam $o t$. Triangula erunt ut prius æquiangula: & ratio $i o$ diametri & $r o$ hoc est $1,007$ — & $1,009\frac{1}{6}$ — id est $2,016\frac{1}{6}$ — ad 66 erit ratio $o t$ ad $t i$, jam adde quadrata $o t$, $t i$ $4,064,828\frac{1}{3}\frac{1}{6}$ — & $4,356$. totum erit pro quadrato diametri. & tum diameter erit $2,017\frac{1}{4}$ — Quare diameter $o i$ ad $i t$ est minoris rationis quam $2,017\frac{1}{4}$ ad 66 . Contraq; latus $i t$ ad $i o$ majoris est rationis quam 66 ad $2,017\frac{1}{4}$. Et sic quarta fuit anguli bisectionis: ubi $t o i$ est $\frac{1}{8}$ recti. & quidem $\frac{1}{9}$ peripheriæ. Nam $u o i$ est $\frac{1}{2}$ ergo $s o i$ est $\frac{1}{4}$ & $r i o$ $\frac{1}{8}$ itaq; $t o i$ $\frac{1}{9}$ totius peripheriæ. Quare recta $i t$ est nonagesima sexta pars inscripti multanguli. Neq; modus ille duplicati anguli è prima parte huc repetitur: quia sumitur tota diameter non radius. itaque fabrica

sic

sic est: per quam inventum latus nonagies sexies inscriptum totam peripheriam subrendet. Hinc jam ipsa ratio ita patet. cum latus inscripti sit 66. hoc per 96 multiplicatum, faciet perimetrum totam 6,336. At diameter est 2,017 $\frac{1}{4}$. Quare ratio 6,336 ad 2,017 $\frac{1}{4}$ est tripla major 28 $\frac{1}{4}$ ipsius diametri ut ex Arithmetica inventionem constat. Vel, ut ante, è perimetro tolle 2,017 remanebunt 285. hinc tolle ter $\frac{1}{4}$ hoc est $\frac{3}{4}$ relinquentur 284 $\frac{1}{4}$ ipsius diametri. Hæc reliqua majora sunt $\frac{1}{2}$ ergo quam $\frac{1}{8}$ majora existunt. itaq; perimenter inscripti multanguli superat diametrum triplo & sesquioctavo. ideoq; peripheria major, quia continens, multo magis superat.

Quare ut tota Archimedeæ demonstratio concludatur: peripheria diametri est tripla & ferè sesquiseptima. Minor enim est sesquiseptima, major sesquioctava. sed propior sesquiseptimæ: illic enim deest unitas unius septimæ: hic reliquum partibus plurimis majus quam $\frac{1}{2}$ & ideo quam $\frac{1}{8}$. Quare vicinum magis & vero propinquum assumptum.

Et hoc Archimedeum ratiocinium tota posteritas fermè retinuit: eoq; vulgo data diametro aut peripheria alterutrum investigatur. statuitur enim peripheria talium 22 qualium diameter est 7. Ergo si detur peripheria 88. erit ut

22 ad 7 sic 88 ad 28 pro diametro quæsita. Et sic deinceps.

Detur rursus diameter 56. Quæritur in tali mensura peripheria. Erit ergo

ut 7 ad 22 sic 56 ad 176 pro peripheria quæsita. Non est occlusa via perveniendi etiam Archimedeo modo ad accuratorem rationem. poterit enim assumi multangulū adscribendum multorum laterum aliquot centenorum aut millenorum millium. & radius similiter partium vel centies millies millenarum millium. Nam tum accuratius inveniri terminos rationis nullum est dubium. Hoc cuilibet Mathematicum candidato tractandum relinquo. Et hinc jam geodæsia circuli est.

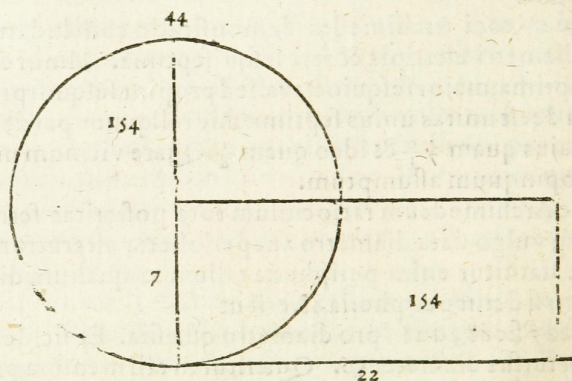
Itaq;

2. Planus è radio & peripheria dimidio est area circuli.

Archimedes

Archimedes in dimensione circuli triangulū ē semisse perimetri tanquam altitudine & diametro tanquam basi circulo æquat. Hinc varia extiterunt axiomata, planum radii & peripheriæ duplum esse areæ circuli, Theon 2. c. 1. in Ptolem. & paulo post: Planum semissis radii & perimetri esse aream. Rursus: Planum diametri & quartæ partis peripheriæ esse aream. Et alia plura. Quæ tamen ex elemento jam polito cognita parallelogrammi doctrina non erunt ignota.

Esto jam peripheria data 44. etiam ignota diametro. e a enim per 1 e dabitur 14.



jam planus ē 7 & 22 hoc est 154 est area circuli.

Rectanguli autem huiusmodi oblongi latera duo opposita sunt in diametro: & in peripheria duo reliqua opposita continentur. Quare binorum dimidia assumuntur tantum: cum ab iis rectangulum comprehendatur per 1. c. 2. e. 11. R.

Et

3. ut 14 ad 11, sic quadratum diametri ad circulum.

Proportio diametri quadratæ ad aream circuli ex Archimede illa ratione est. Et dantur hic tres termini proportionis potestate. unde circulus invenitur.

Sit

Sitenim diameter 14 ejus quadratum est 196. jam ut 14 ad 11, sic 196 erit ad circuli aream: quæ propterea erit 154 ut ante. Et hoc è dimenso circulo & quadrato per analysin patet. Nam ratio 196 ad 154 est ratio 14 ad 11.

Et est hic tetragonismus paulo à superiori diversus: Est q; Euclidis apud Heronem propositus. paulo tamen secus eo scilicet modo quo à sphaericis (sic enim elementarii Astronomi salutantur) vulgò proponitur. Si de quadrato diametri $\frac{1}{4}$ tollantur: relinquetur area circuli. ut in addito exemplo experiri potes. Nam $\frac{1}{4}$ de 196 sunt 42 quibus ablati de 196 relinquantur 154 pro area circuli.

Et

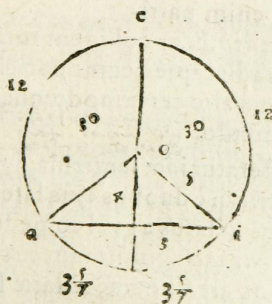
4. Planus è radio & peripheriæ quadrante est area semicirculi.

ut retento superiori exemplo planus è 7 radio per 11 quadrantem peripheriæ nempe 77 est semicirculus. Sed, ut ex definitione semicirculi patet, potest dimensio isthæc fieri sumpto dimidio dimensi jam circuli.

Et

5. Planus è radio & basis dimidio est area sectoris in centro.

Ex eodem illo fonte segmentorum geodæsia perficitur. Sint circuli a e i tres sectores quorum bases sint a e 12 pedum, e i item pedum 12, a i vero pedum $7\frac{3}{4}$. Erit ergo per 1 e radius 5. diameter enim invenitur pedum 10. jam multiplica 5 per 6. factus erit sector alteruter æqualiū nempe pedum 30. Rursus multiplica 5 in $3\frac{5}{7}$. quotus erit $18\frac{4}{7}$ pro tertio sectorē. Et ex his additis totus circulus restituitur $78\frac{4}{7}$. quantus inveniretur esse ex præcedentibus.



Et

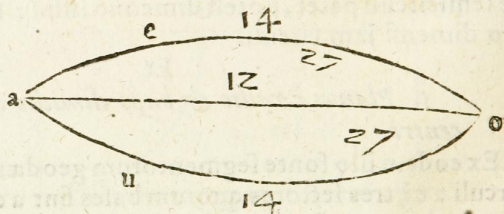
6. Si triangulum è duobus radiis & basi majoris sectionis addatur duobus in ea sectoribus centri: totus erit area sectionis majoris: sin detrahatur suo sectori: reliquum erit area minoris.

ut in præmisso schemate sit triangulum a o i pedum 12 nempe si a i basis majoris sit pedum 6: erit altitudo 4. hinc 6 per 2 aut 4 per 3 faciunt 12 pro area trianguli. jam si hæc duob. sectoribus suis a o e, e o i nempe 60 addatur: totus 72 erit area majoris sectionis a e i. Rursus idem triangulum tollatur de sectori a o i 18 $\frac{1}{2}$ remanebit minor sectio 67.

Hinc oritur etiam geodæsia plani ovati, & ejus quod vulgò lenticula vocatur.

Esto enim ovale planum a o e u.

cujus arcus æquales sint sigillatim pedum 14. & a o pedum 12. Sigillatim igitur metire a e o, & a u o. tãquam sectiones circuli minores: area enim particulares 27. & 27 colligent totam pedum 54. At unde longitudinem radii capies: cujus noticia in dimensione sectionis requiritur? non alio certe modo: quam a o es dimensus absoluto sectionis circulo.



Offeratur jam lenticula, figura in cujus medio quadrangulum est: utrinque è duobus ejus lateribus semicirculi. ut figura a y o u.

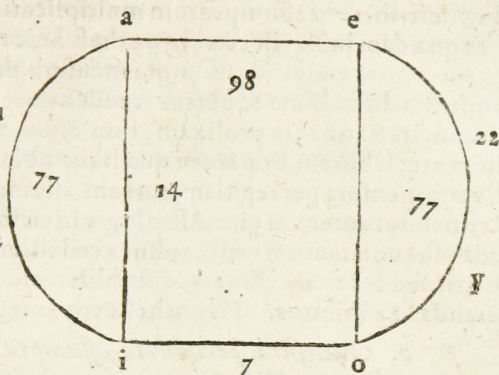
Ejus sit latus a i vel eo pedum 14. i o vero pedum 7. Erit proinde per tetragonismum circuli e y o vel a u i pedum 22.

Hinc area figuræ oblatae facile datur. Nam factus è 14. per 7 hoc

hoc est 98 est area
oblongi a o per
6.e.ii. R.

Et alterutrus
semicirculi area
est 77. Quare figu-
ræ totius area est
252. Et similis geo-
dæsia fuerit in fi-
guris aliis mistis.

Atque ita Geo-
metria circularis
simplex & con-
iuncta fuit. Verum inde non descendemus ad Sphæram: ante-
quam huius Geometriæ thesauros auro nobili quovis precio-
siores introspexerimus.



TH. FINKII GEOME- TRIAE ROTVNDI,

LIBER NONVS.

De canone triangulorum.



*Geometria circulari Canonem triangulorum in
assumpta mensura tam periphæria quam diame-
tri licet conficere.*

Hoc nobis postulatum esto: cuius fabrica ex su-
perioribus cuiusvis in promptu erit. Nam Cano-
nem triangulorum vulgò vocant eum qui rectas semicirculi ad
quadrantis partes descriptas continet. Talé huc transferre volui.
Nihil à Geometriæ sublimitate cõmitti arbitror alienû: si termini
circulares certa mensura definiantur. Sunt Mathematicorum hy-
potheses multæ: licet iis qui regula falsi vulgari utuntur metam

q 2 sibi

sibi præscribere in assumptorum multiplicatione: quod sic facilitas quædam insit. Et certè hypothese huic magna inerit facilitas. Sine enim ejusmodi assumpta mensura præcepta calculi infrequentia difficillima & obscura reddentur: cum propter exemplorum tractationem prolixam, tum etiam investigationis tædium atq; laborem. Et poterit quælibet oblata alia ab assumpta diversa mensura per regulam auream assumptæ accommodari. Retinebitur autem ea quæ Astrologis in cælū est derivata: quod ejus usus non tantum cæli cardines cælestiumque domicilia distinxit: sed & terram climatis distribuit: imò in omni re sic mensuranda sit adhibitus. Hypothesis ergo mensuræ sic erit:

Top: Gradus unus in circulo terrestri, habet 12 miliaria scrupulorum primum, quadrans & miliaria. Scrupulum primum & 17 partes. Officiis positis de molis divisi in scrupulos vel minores alios 60.

2. *Mensura peripherie assumpta sic est: peripheria partibus 360 est divisa: pars in 60 secatur scrupula prima: Scrupulum primum in 60 secunda: & sic deinceps.*

Pars vulgo gradus vocatur: sed usitatus & generalius hic est partis vocabulum. Distributio hæc Ptolemæi est: ante quem in usu fuisse ex Eratosthene & Hipparcho cognoscimus mensuram peripheriæ partium 83. Vide Ptol. 10. c. 1. Pars deinceps quælibet in sua est divisa scrupula sexagesima: quæ suis notis insigniuntur hoc modo:

lineolis ad latus dextrum numeris adpositis. ut si scribas 10 prima 20 secunda 15 tertia. id hoc modo facies

10. 20. 15.

Vulgo etiam putantur habere peculiarem ut notationem sic numerationem maximè conjunctam per tabulam Hexacontadon. At tabula hæc nil nisi reductionem continet factorum è datis terminis: nec semper ea nobis adest.

Retenta hæc fuit Ptolemæi distributio à posteris tam partium peripheriæ quam partium minorum: quod hi numeri 360 & 60 haberent plures mensores. itaq; & quotos vicissim metientes: proindeq; essent ad numerationes aptiores & magis accommodati. Sunt enim numeri peripheriæ 360. mensores primi quidem

dem 1, 2, 3, 5. Compositi vero 4, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30, 36, 40, 45, 60, 72, 90, 120, 180, 360, numero viginti quatuor: ut ex Arithmetica inventione pater.

Sic 60 invenies mensores duodecim 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60.

Sed typus utriusq; exempli rem ob oculos ponet

1	360
5	72
3	120
15	24
9	40
2	180
10	36
6	60
30	12
18	20
90	4
45	8

Quo significatur: si divides 360 in 5 tum $\frac{1}{5}$ fore 72: si in 3 tum $\frac{1}{3}$ fore 120. Si in 90 tum $\frac{1}{90}$ fore 4. Vel contra si concipias 360 dividi in 72 tū $\frac{1}{72}$ erit 5. si in 120 tum $\frac{1}{120}$ erit 3. si in 4 tū $\frac{1}{4}$ erit 90.

Sic in mensura minutorum ac scrupulorum

1	60
3	20
5	12
15	4
2	30
6	10

Si 60 in 3 divides $\frac{1}{3}$ erit 20. si in 5. tum $\frac{1}{5}$ erit 12 vel contra: ut ex Arithmetice inventionibus constat. Et hinc jam facile erit peripheriam in partes assis secare: quod utile est. Sæpe enim apud auctores elegantie studiosos assis nominibus anguli & arcus nominantur. Quare ut in promptu sint hic accipe.

q 3 In

uncia	30 ^{grad}	In partibus	
Sextans	60	Bes	240
Quadrans	90	Dodrans	270
Triens	120	Dextans	300
Quincunx	150	Deunx	330
Semissis	180	As	360.
Septunx	210		

uncia partium nomina raro imposi-
ta hisce partibus leguntur.

Sic in scrupulis

As	60	Semissis	30	uncia	5
Deunx	55	Quincunx	25	Semuncia	2 30
Dextans	50	Triens	20	Duella	1 40
Dodrans	45	Quadrans	15		
Bes	40	Sextans	10		

Ergo hæc assumpta mensura esto : ad quã regula aurea omnes alias accommodabit. Sic Ptolemæus dicit Eratosthenem observasse tropicorum distantiam partium 11 qualium circulus in peripheria habet 83. Quæritur quanta fuerit in nostra mensura. Aurea regula respondebit. Si cum peripheria est partium 83 distantia est 11. Ergo si peripheria sit 360 distantia erit 47 42' 39" & paulo ultra. hoc est partium 47 & partis plus besse, minus dodrante.

3. Diameter assumitur partium 20,000,000.

Si ratiocinium Archimedeum sequamur ex assumpta peripheriæ mensura diameter esset $114\frac{6}{7}$. At Ptolemæus contentus ratione peripheriæ ad diametrum qualicumque diametrum ponit 120. Quod nulla habita ratione peripheriæ ad diametrum fieri potest. unde recentiores ut scrupulorum evitarent involutionem in multiplicationibus & divisionibus numerorum circa ipsas lineas, quæ ut plurimum sunt asymmetræ : alii aliter rationalem constituerunt diametrum. Arzachel eam posuit partium 300. Regiomontanus 12,000,000. item 20,000,000. quæ mensura deinceps est retenta, à Copernico tamen Apiano & aliis circulis duobus imminuta. Nonnulli retinent Ptolemæi mensuram, & canones suos ad sexagenariam revocant numerationem.

ut p[ro]ferat regim[us] Dan[ic]ens[is]. Quæ

Assumpta di-
ameter p[ro]
lib. 4. n.

Quæ ratio vel eo nomine est laboriosa: quod canone tali uti non possis nisi crebra inspectione tabulæ numerationis astronomi- cæ: quæ non semper adest: & si adsit visum nõ mediocriter lædit.

Posita jam hac diametro facile erit nobis canonem triangulo- rum ad singulos quadrantis gradus singulorumq; minuta perficere. Cujus usus ut melius innotescat & altius hæreat: ejus syn- taxin breviter è superioribus reperam: primò quidem canonis sinuum, via Ptolemæi ac Regiomontani & Purbachii. Latera itaq; inscriptorum rectilineorum ex libro septimo sic habent:

Trianguli	120.	17, 320, 508	14 e
Quadrati	90	14, 142, 136	4 e
Quinquanguli	72	11, 755, 704	20 e
Sexanguli	60	10, 000, 000	11 e
Decanguli	36	6, 180, 340	19 e
Quindecanguli	24	4, 158, 234	22 e

jam per 10. e. 5 erunt sinus

p. 60	8, 660, 254
45	7, 071, 068
36	5, 877, 852
30	5, 000, 000
18	3, 090, 170
12	2, 079, 117

*Ex a. sin. y e
a. sin. y e
a. sin. y e*

Et hinc per 9. e. 5 sinus colliguntur complementorum nempe

p. 54	8, 090, 170
72	9, 510, 565
78	9, 781, 476.

His jam sinibus datis invenies per 20. e. 5 sinus semissium pe- ripheriarum: & hinc tum per 9. e. 5 sinus complementorum se- missium: & continuè in his deinceps. Exempli gratia datur si- nus 54. & ejus complementi 36. illic 8, 090, 170 hic 5, 877, 852. Quod si jam velis quærere sinum arcus 27 semissis nempe 54. Quæres sinu secundu p 54 per 17. e. 5 nempe 10, 000, 000 minus 5, 877, 852 hoc est 4, 122, 148. jam per 20. e. 5 ut 5, 000, 000 ad sinu arcus 27. sic sinus 27 ad 4, 122, 148. Ergo ex proportionem continua-
latus

latus facti à 5,000,000 per 4,122,148 nempe 4,539,905 est sinus
quæstus nempe peripheriæ gr. 27.

Eodem ratiocinio inuenies sinum cuiuscunq; dimidii arcus:
sic huius ipsius nempe p. 13,30 & rursus huius p. 6,45 tum singu-
lorum complementorum sinus primo. 63. tum p. 76,30 tum p. 83,15. Et
horum complementorum dimidiorum sinus ut p. 31,30 rursus p. 15,
45 & 38,15. Et horum rursus complementa assumes: inuenies si-
nus p. 58,30. p. 74,15 p. 51,45. Et horum sumere potes semisses
p. 15,45. p. 29,15 & horum complem. p. 74,15 & p. 60,45.

Sic examinatis reliquis arcubus multorum inuenies sinus.
Sume gr. 30. ejus sinum habes. ergo per præmissum ratiocinium
inuenies sinum gr. 15. & hinc sinum complementi gr. 75. jam rur-
sus ex sinibus gr. 15 & gr. 75 inuenies sinus gr. 7,30, gr. 37,30 gr. 82,
30 gr. 52, 30. Rursus ex his inuenies sinus gr. 3,45 gr. 18,45 gr. 41,
15 gr. 36,15 gr. 86,15 gr. 71,15 gr. 48,45 gr. 63,45.

Sic si sumas g. 45 sinum: inuenies hinc simili inductione sinus
gr. 22,30 gr. 67,30 gr. 11,15 gr. 33,45 gr. 78,45 gr. 56,15.

Sic si assumus sinum gr. 18 inuenies methodo simili sinus gr. 9.
gr. 81. gr. 4,30 gr. 40,30. gr. 85,30 gr. 49,30. gr. 2,15 gr. 20,15 gr. 42,
45 gr. 24,45 gr. 87,45 gr. 69,45 gr. 47,15 gr. 65,15.

Rursus sumas 12 sinum. habebis hinc sinum gr. 6 & 84. gr. 3. gr.
42 gr. 87 gr. 48 gr. 1,30 gr. 21. gr. 43,30 gr. 24 gr. 88,30 gr. 69. gr. 46,
30 gr. 66. gr. 0,45 gr. 10,30 gr. 21,45 gr. 44,15 gr. 34,30 gr. 23,15 gr. 33.
gr. 89,15 gr. 79,30. gr. 68,15. gr. 45,45. gr. 55,30. gr. 66,45 gr. 57. & ex
his rursus semissium, semissiumq; complementorum. prout non
tantum in his sed & aliis numeris calcographus inductionem
instituet & calculum adhibebit. Et sic maxima pars canonis ab-
soluta est. Verum in iis ipsis compendium syntaxeos supra ad
15. e. 7. propositum non est negligendum. Eo enim sola numera-
tio simplex sinum inueniet. Exempli gratia habes sinum è su-
perioribus gr. 17,15 habes etiam sinum gr. 42,45.

Illic 2,965,416.

Hic 6,788.007

Ergo his additis

9,753,423

habes sinum arcus com-
positi

positi è gr. 60 & 17,15 hoc est g. 77,15. Quia uterq; 42,45 & gr. 77,15 eodẽ intervallo abest à partibus 60 nempe sextante peripheriæ.

Sichabes sinum 78 item sinum gr. 18.

Illic 9,781,476

Hic 3,090,170

Ergo invicem sublati 6,691,306 erit pro sinu gr. 60—18 hoc est gr. 42. quem laboriosius prædicto modo investigasses.

Rursus habes sinum gr. 66. & 54.

Illic 9,135,455

Hic 8,090,170

Ergo reliquus 1,045,285 erit pro sinu gr. 6. quanto nempe intervallo alteruter datorum arcuum à gr. 60 abest. Eodem modo in reliquis inducenti calcographo magnum syntaxeos compendium paratum est. jam vero pro complendo canone sinus gr. 1 & scrupuli 1 investigandus est. idque ex collatione fiet. Si non præcisè inveniemus: inveniemus tamen $\omega s \epsilon \chi \nu s a$.

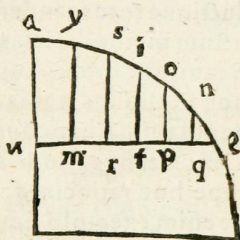
Esto in subiecta figura arcus a e gr. 1. 36. a i vero gr. 0,45. Et sit a o gr. 1 cuius sinus quaeritur. Et sit sinus a e quidem recta u e. arcus vero a i recta u t. quaeritur ergo u p. dividatur a e in sex æquales partes nempe quadrantes gradus unius. Datur autem ex inventione superioris u t 130,896. u e vero 261,769. jam si divides u t in tres æquales partes habebis 43,632 quæ est major quam m r, vel r t, ideoque etiam major quam t p per 12. e. 5. jam si addas u t

$$\begin{array}{r} 130,896 \\ \& 42,622 \\ \hline 174,520 \end{array}$$

habebis summam majorem certe quam sit u p sinus unius gradus.

Rursus quia u t est 130,896. & u e vero 261,769. erit t e 130,873. cuius tertia pars est 43,624 $\frac{1}{3}$ quam constat eodem prædicto modo esse minorem quam t p.

jam



jam si addas ut 130,896
& 43,624

habebis summam 174,520 minorem sane quam sit u p gra
dus unius sinus. *invenit in q. 12. et q. 13. methodo*

Quare cum 174,528 sit major. 174,520 sit minor: medium certe eligamus oportet quo sine sensibili errore uti possimus nempe 174,524 pro sinu unius gradus.

Hinc jam ex superioribus viis ac modis innotescet sinus complementi 89. item sinus semisus 30' & 44,30' cum 89.30' & 45 30'. rursus hinc sinus 15 gr. 22,15. gr. 44,45 gr. 22,45 gr. 89,45 gr. 57,45. gr. 45,15 gr. 67,15. & sic deinceps.

Simili collatione maximè vicinorum colligetur sinus scrupuli unius 2,909 fere, parum enim deest. Hinc dabitur sinus duorum scrupulorum ex præcedenti methodo ut illic diminutionis sic hic auctoris viâ ex 20. e. 5. Dehinc 4' item 8', 16', 32', & horum complementorum & semisium complementorum. Atq; simili inductione totus tandem perfectus canon est: quem hisce constructum methodis scias.

Sequitur canonis hujus triangularum pars altera, quæ vulgo canon secundus, nobis canon tangentium dicitur: & canon hypotenusarum Rhetico, nobis canon secantium vocatur.

Canon tangentium à Rheinholdo componitur per 24. e. 5. nempe hoc ratiocinio: ut sinus arcus verbi gratia graduum 89 (hoc enim exemplo Erasmus utitur) nempe 9,998,477 ad sinum complementi nempe gradus unius 174,524, sic radius ad 174,551 tangentem gradus unius. Sed hoc tamen notandum est cum sinus gr. 1. non præcisè habeatur, nec hanc tangentem esse accuratam.

Canon secantium, seu ut à Rhetico vocatur canon hypotenusarum à Rheinholdo eodem loco componitur per 28. e. 5. ut si sinus arcus exempli gratia 89 nempe 9,998,477 ad radius sic radius ad 10,001,523 secantem gr. 1. ubi quod de tangente ante monui, idem hic non transeo.

Hæc

Hæc methodus est: sed comparatio tangentis & secantis compendia largitur ea de quibus est 30 & 31. e. 5. quæque ad syntaxin per se iam numerationem primam plurimum conducunt: si superiori methodo tangentes arcuum in promptu sint. Sola enim tum ut dixi numeratio prima reliquam canonis triangulorum partem perficiet. Exempli gratia.

Tangens gr. 1. est	174,550.	At semissis hujus
complementi est	9,826,974	tangens gr. 44 $\frac{1}{2}$.

Ergo summa	10,001,524	est pro secante unius gradus.
Rursus quia datur secans unius gradus jam inventa	10,001,525.	& constat tan-
gens gr. 1.	174,551	

Ergo summa 10,176,076 est pro tangente gr. 45 $\frac{1}{2}$ nempe data peripheriæ gr. 1. auctæ semisse sui complementi.

Et sic simul canon tangentium canonem secantium componit, & ab eo vicissim componitur: sic necesse sit. Sequitur de usu qui tamen ex jam dictis notus esse poterat.

4. Canonis exterior pars in margine supero partes peripheriæ quadrantis, in sinistro partium scrupula prima continet: interea in area communi partis scrupulig, rectas semicirculi.

Et hoc elementum syntaxeos est. pars exterior nobis duobus membris perficitur margine supero & sinistro. qui vulgo caput, frons, suprema pars tabulæ item limes & latus finistrum dicuntur. in hisce itaq; marginibus canon ita continetur ut arcus in his sint totius quadrantis: ejusq; gradus singuli nempe 90 singulorumq; minuta prima, gradus margine supero continentur, gradiumq; scrupula finistro.

Interior pars vulgo venter tabulæ dicitur. ea areas continet lineis duplicibus distinctas transversis & perpendicularibus. area illæ (quæ vulgo communis angulus, communis intersectio, profelis angularis dicuntur) continent in communi con-

1 2 cursu

*Ubi Canonis q. de
plex E. Uel. et
recta veluti sing
q. q. n. t. a. n. i. s. c.
respondens: Uel
contra dat. ang.
q. q. n. t. u. r. recta.*

Observandum est qd. numerus hic semper
crescit, at in alijs (ut in Copernico) non
interdum venire solet ut de reser-
vatione; tum obtrahenda e differe-
rentia.

ROTVNDI, LIB. IX. 133

præcedentis nempe gr. 20,30 est 3,502,075. Ergo differentia est 2,724. ut in sequenti typo patet.

Seq. dat. gr. 20,31	Datum ipsum gr. 20,30,20"	P. 3,504,799
præ. dat. gr. 20,30	præced. dat. gr. 20,30	P. 3,502,075
	20"	2,724

jam differentie 20" est concludenda pars proportionalis è 2,724. Quare ut scrupulum 1 hoc est ut 60 secunda: nam terminos esse proximo genere homogeneos oportet: ut inquam 60 se habent ad 2,724: sic 20 se habebunt ad partem proportionalem quaesitam 908.

60 20 2,724 908 præcedentis
Hæc pars proportionalis addenda erit sinui proximè sequen-
tis dati nempe 3,502,075 & summa 3,502,983 est sinus quaesitus
peripheriæ nimirum gr. 20,30,20". Et sic sinus inventus est.

Tangens quoq; simili modo invenietur. retentis enim diffe-
rentiis datorum: tangens grad. 20,31 est 3,742,164 at tangens
gr. 20,30 est 3,738,848.

Ergo differentia erit 3,316. ut sequens typus ob oculos ponit.

Seq. D. gr. 20,31	Dat. gr. 20,30,20"	Q. 3,742,164
præ. D. gr. 20,30	præc. gr. 20,30	Q. 3,738,848
	20"	3,316

Itaq; si 60 dant differentiam 3,316
tum 20 dabunt 1,105 $\frac{1}{3}$ proportionalem
partem addendam ad 3,738,848.
Et sic summa 3,739,953. erit pro tangente quaesita.

Eodem modo ex canone secantium dati arcus secans inve-
nietur 10,676,483.

Cæterum in usu ii qui nec curiosi nimium nec nimis sunt scru-
pulosi radio contenti sunt 100,000. Quare & reliquis reliquo-
rum arcuum sinibus, tangentibus, secantibus duas dextras fi-
r 3 guras

guras five notas præcidunt: ita tamen ut tertiæ addatur unitas si rejectæ duæ 50 superarint. Sic illis sinus gr. 20,30' est 35,021. nempe rejectis 7 & 5 à fine & addita ad 0 unitate.

*In tangentibus
& secantibus
t. ref. sed in
sinibus non
perfecti non
merguntur
magis.* Hoc ut in calculo non nimis accurato locum habere potest: ita tamen in sinibus non semper locum invenit: iis nempe qui radio non multo sunt minores. Fiet enim tum ut sinus idem diversis arcubus competat: exempli gratia radius 100,000 non tantum comperet gr. 90 sed etiam gr. 89,59'. gr. 89,58'. grad. 89,57' usq; ad 50 scrupula prima. rursus sinus 99,999 non tantum erit gr. 89,49' sed & 89,42' atq; intermediarum.

Quare ut præcisio hæc admitti commode potest in tangentibus, secantibus, sinibus etiam quorum paulo major est differentia: sic in sinibus quorum differentia jam paulatim decrescendo ferè evanescunt locum habere non videtur.

Copernicus & Rheticus atque alii areales canonibus suis addiderunt differentias: addidit etiam Rheinholdus. Verum idem nobis esse faciendum non putavimus. Cum enim differentia non sit magna competens scilicet 1 scrupulo: non difficile erit eam prima inspectione invenire Arithmeticæ peritos. quales esse necesse est omnes eos qui hæc adire eorumque cognoscere usum volent. non, inquam, difficile erit: maximè si duæ præcendantur ab initio notæ. nec nimium chartarum excrescere cumulum voluimus. Quod si sunt qui omillas differentias non ferunt: ii ipsi differentias inquirant ac annotent. Et annotari quidem possunt inter ipsos numeros quorum sunt differentia tenui aliquo calamo: & sic semel inventæ semper esse usui possunt. Ac possunt hoc modo per ocium differentia inquiri. Quoties enim postulat exemplum inventionem sinuum: tum methodo jam dicta investigabis: & differentiam tum inventam annotabis. Sic successu temporis omnium omnino arearum differentias per lulum quasi cognoscas & annotabis.

Atq; sic partis proportionalis inventio in ipsis areis quæsitum invenit: eadem erit ratio in marginibus.

Detur enim sinus 3,502,983.

Quæritur

Quæritur arcus ei competens

Sinus datus in canonis sua parte nempe arcis quæsitus non invenitur præcisè. Sed eo minor proximè est 3,502,075. Ergo differentia hujus à dato est 908.

jam proximè sequens sinus est 3,504,799. ergo differentia hujus & proximè præcedentis est 2,724.

Tertio sinui proximè sequenti competit arcus gr. 20,31 præcedenti gr. 20,30. Ergo differentia est 1 scrup. primum. quanta semper hic est ut sequens typus monstrat.

Da. se. 3,504,799	Dat. 3,502,983	Q. 20,31
Da. pr. 3,502,075	pr. 3,502,075	Q. 20,30
2,724	908	1

jam hinc concludenda est pars proportionalis congruens è 60 secundis differentiæ 908. Ergo si differentia datorum vicinorum 2,724 est secundorum 60, differentia 908 erit secundorum 20. pro parte p. quæsitæ.

2,724 908 60 20.

jam si hæc addatur quæsito proximè præcedenti erit quæsitus arcus. grad. 20,30,20". Si modo arcus quærendus fuit quadrantis periphæria minor. Nam sinus datus per 8. e. 5 competit etiam grad. 159,29,40" periphæriæ nempe reliquæ ad semiperiphæriam.

Quod jam inscriptarum & sinuum secundorum inventionem attinet: ea his cognitis per 10,17, & 18. e. 5 non est obscura. Si enim inscripta arcus gr. 41 & 40 secundorum quærat: quæretur sinus semisus nempe gr. 20,30,20". Sinus inventus 3,502,983 si duplicetur est quæsitæ inscriptæ nempe 7,005,966.

Rursus si quærat arcus inscriptæ 7,005,966 inscriptæ dimidiæ tanquam sinus 3,502,983 arcum quæro nempe gr. 20,30,20". is duplicatus est arcus quæsitus.

Quæ

Quæ sinus secundos attingunt: etiam facilia sunt. Sit quærendus sinus secundus arcus gr. $69,29',40''$. quæretur complementi nempe grad. $20,30',20''$ sinus $3,502,983$. is enim de radio relinquit $6,497,017$ pro sinu secundo quæsito.

Quod si sinus secundi arcus quærat: sinus de radio relinquit sinum complementi arcus quæsit.

Rursus si quærat sinus secundus arcus grad. $110,36',20''$ per 18. e. 5. sinus complementi $3,502,983$ cum radio est sinus secundus quæsit.

Si sinus ejusmodi secundus radio minuatur relinquitur sinus arcus qui cum quadrante restituit arcum quæsitum.

Et hætenus Canonis syntaxis & usus: sequitur ipse Canon.

CANON

CANON SI-
nuum

RHETICO

Canon basis & perpendiculi
primus.

part. m. lat.	0	1	2	3	4
0	0	174,524	348,995	523,360	697,565
1	2,909	177,433	351,902	526,265	700,467
2	5,818	180,341	354,809	529,170	703,369
3	8,727	183,250	357,716	532,075	706,270
4	11,636	186,158	360,623	534,980	709,172
5	14,544	189,066	363,530	537,884	712,073
6	17,453	191,975	366,437	540,789	714,975
7	20,362	194,883	369,344	543,694	717,876
8	23,271	197,792	372,251	546,598	720,777
9	26,180	200,700	375,158	549,503	723,678
10	29,088	203,608	378,064	552,407	726,579
11	31,997	206,517	380,971	555,312	729,480
12	34,906	209,425	383,878	558,216	732,381
13	37,815	212,333	386,785	561,120	735,282
14	40,724	215,241	389,692	564,024	738,183
15	43,632	218,149	392,598	566,928	741,084
16	46,541	221,057	395,505	569,832	743,985
17	49,450	223,965	398,412	572,736	746,886
18	52,359	226,873	401,318	575,640	749,787
19	55,268	229,781	404,225	578,544	752,688
20	58,177	232,689	407,131	581,448	755,588
21	61,086	235,597	410,038	584,352	758,489
22	63,995	238,505	412,944	587,256	761,389
23	66,904	241,413	415,851	590,160	764,290
24	69,813	244,321	418,757	593,064	767,180
25	72,721	247,229	421,663	595,967	770,090
26	75,630	250,137	424,570	598,871	772,991
27	78,539	253,045	427,476	601,775	775,891
28	81,448	255,953	430,382	604,678	778,791
29	84,357	258,861	433,288	607,582	781,691
30	87,265	261,769	436,194	610,485	784,591

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S I N V V M.

139

4	0	1	2	3	4
30	87,205	261,769	436,194	610,485	784,591
31	90,174	264,677	439,100	613,389	787,491
32	93,083	267,585	442,006	616,292	790,391
33	95,992	270,493	444,912	619,196	793,291
34	98,901	273,401	447,818	622,099	796,191
35	101,809	276,308	450,724	625,002	799,090
36	104,718	279,216	453,630	627,905	801,990
37	107,627	282,124	456,536	630,808	804,889
38	110,536	285,032	459,442	633,711	807,789
39	113,445	287,940	462,348	636,614	810,688
40	116,353	290,847	465,253	639,517	813,587
41	119,262	293,755	468,159	642,420	816,486
42	122,171	296,663	471,065	645,323	819,385
43	125,079	299,570	473,970	648,226	822,284
44	127,988	302,478	476,876	651,129	825,183
45	130,896	305,385	479,781	654,031	828,082
46	133,805	308,293	482,687	656,934	830,981
47	136,714	311,200	485,592	659,837	833,880
48	139,622	314,108	488,498	662,739	836,778
49	142,531	317,015	491,403	665,642	839,677
50	145,439	319,922	494,308	668,544	842,575
51	148,348	322,830	497,214	671,447	845,474
52	151,257	325,737	500,119	674,349	848,372
53	154,165	328,645	503,024	677,251	851,271
54	157,074	331,552	505,929	680,153	854,169
55	159,982	334,459	508,834	683,055	857,067
56	162,891	337,367	511,740	685,957	859,965
57	165,799	340,274	514,645	688,859	862,863
58	168,708	343,181	517,550	691,761	865,761
59	171,616	346,088	520,455	694,663	868,659
60	174,524	348,995	523,360	697,565	871,557

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	5	6	7	8	9
0	871,557	1,045,285	1,218,693	1,391,731	1,564,345
1	874,455	1,048,178	1,221,580	1,394,612	1,567,218
2	877,353	1,051,071	1,224,467	1,397,492	1,570,091
3	880,250	1,053,964	1,227,354	1,400,373	1,572,964
4	883,148	1,056,857	1,230,241	1,403,253	1,575,837
5	886,045	1,059,749	1,233,128	1,406,133	1,578,709
6	888,943	1,062,642	1,236,015	1,409,013	1,581,581
7	891,840	1,065,534	1,238,901	1,411,893	1,584,453
8	894,737	1,068,426	1,241,788	1,414,772	1,587,325
9	897,634	1,071,318	1,244,674	1,417,652	1,590,197
10	900,531	1,074,210	1,247,560	1,420,531	1,593,069
11	903,428	1,077,102	1,250,446	1,423,410	1,595,941
12	906,325	1,079,994	1,253,332	1,426,289	1,598,812
13	909,222	1,082,886	1,256,218	1,429,168	1,601,684
14	912,119	1,085,778	1,259,104	1,432,047	1,604,555
15	915,016	1,088,669	1,261,990	1,434,926	1,607,426
16	917,913	1,091,561	1,264,876	1,437,805	1,610,297
17	920,809	1,094,452	1,267,761	1,440,684	1,613,168
18	923,706	1,097,344	1,270,647	1,443,562	1,616,038
19	926,602	1,100,235	1,273,532	1,446,441	1,618,909
20	929,498	1,103,126	1,276,417	1,449,319	1,621,779
21	932,395	1,106,017	1,279,302	1,452,197	1,624,649
22	935,291	1,108,908	1,282,187	1,455,075	1,627,519
23	938,187	1,111,799	1,285,072	1,457,953	1,630,389
24	941,083	1,114,690	1,287,957	1,460,831	1,633,259
25	943,979	1,117,580	1,290,841	1,463,708	1,636,129
26	946,875	1,120,471	1,293,726	1,466,586	1,638,999
27	949,771	1,123,361	1,296,610	1,469,463	1,641,868
28	952,667	1,126,252	1,299,494	1,472,340	1,644,738
29	955,563	1,129,142	1,302,378	1,475,217	1,647,607
30	958,458	1,132,032	1,305,262	1,478,094	1,650,476

	5	6	7	8	9
30	958,458	1,132,032	1,305,262	1,478,094	1,650,476
31	961,354	1,134,922	1,308,146	1,480,971	1,653,345
32	964,249	1,137,812	1,311,030	1,483,848	1,656,214
33	967,144	1,140,702	1,313,914	1,486,724	1,659,082
34	970,039	1,143,592	1,316,798	1,489,601	1,661,951
35	972,934	1,146,482	1,319,681	1,492,477	1,664,819
36	975,829	1,149,372	1,322,564	1,495,353	1,667,687
37	978,724	1,152,261	1,325,447	1,498,229	1,670,555
38	981,619	1,155,151	1,328,330	1,501,105	1,673,423
39	984,514	1,158,040	1,331,213	1,503,981	1,676,291
40	987,408	1,160,929	1,334,096	1,506,857	1,679,159
41	990,303	1,163,818	1,336,979	1,509,733	1,682,027
42	993,198	1,166,707	1,339,862	1,512,608	1,684,894
43	996,092	1,169,596	1,342,744	1,515,484	1,687,761
44	998,987	1,172,485	1,345,627	1,518,359	1,690,628
45	1,001,881	1,175,374	1,348,509	1,521,234	1,693,495
46	1,004,775	1,178,263	1,351,392	1,524,109	1,696,362
47	1,007,669	1,181,151	1,354,274	1,526,984	1,699,229
48	1,010,563	1,184,040	1,357,156	1,529,859	1,702,095
49	1,013,457	1,186,928	1,360,038	1,532,734	1,704,962
50	1,016,351	1,189,816	1,362,920	1,535,608	1,707,828
51	1,019,245	1,192,704	1,365,802	1,538,482	1,710,694
52	1,022,139	1,195,592	1,368,683	1,541,356	1,713,560
53	1,025,032	1,198,480	1,371,564	1,544,230	1,716,426
54	1,027,926	1,201,368	1,374,446	1,547,104	1,719,292
55	1,030,819	1,204,255	1,377,327	1,549,978	1,722,157
56	1,033,713	1,207,143	1,380,208	1,552,852	1,725,022
57	1,036,606	1,210,031	1,383,089	1,555,725	1,727,887
58	1,039,499	1,212,918	1,385,970	1,558,599	1,730,752
59	1,042,392	1,215,806	1,388,851	1,561,472	1,733,617
60	1,045,285	1,218,693	1,391,731	1,564,345	1,736,482

	10	11	12	13	14.
0	1,736,482	1,908,090	2,079,117	2,249,511	2,419,219
1	1,739,347	1,910,945	2,081,962	2,252,345	2,422,041
2	1,742,211	1,913,800	2,084,807	2,255,179	2,424,863
3	1,745,075	1,916,655	2,087,652	2,258,013	2,427,685
4	1,747,939	1,919,510	2,090,497	2,260,847	2,430,507
5	1,750,803	1,922,365	2,093,342	2,263,680	2,433,329
6	1,753,667	1,925,220	2,096,180	2,266,513	2,436,150
7	1,756,531	1,928,074	2,099,030	2,269,346	2,438,971
8	1,759,394	1,930,928	2,101,874	2,272,179	2,441,792
9	1,762,258	1,933,782	2,104,718	2,275,012	2,444,613
10	1,765,121	1,936,636	2,107,562	2,277,844	2,447,434
11	1,767,984	1,939,490	2,110,405	2,280,676	2,450,254
12	1,770,847	1,942,344	2,113,248	2,283,508	2,453,074
13	1,773,710	1,945,197	2,116,091	2,286,340	2,455,894
14	1,776,573	1,948,050	2,118,934	2,289,172	2,458,714
15	1,779,435	1,950,903	2,121,777	2,292,004	2,461,533
16	1,782,298	1,953,756	2,124,620	2,294,835	2,464,352
17	1,785,160	1,956,609	2,127,462	2,297,666	2,467,171
18	1,788,022	1,959,462	2,130,304	2,300,497	2,469,990
19	1,790,884	1,962,314	2,133,146	2,303,328	2,472,809
20	1,793,746	1,965,166	2,135,988	2,306,159	2,475,628
21	1,796,608	1,968,018	2,138,830	2,308,949	2,478,446
22	1,799,469	1,970,870	2,141,671	2,311,781	2,481,264
23	1,802,331	1,973,722	2,144,512	2,314,649	2,484,082
24	1,805,192	1,976,574	2,147,353	2,317,479	2,486,900
25	1,808,053	1,979,425	2,150,194	2,320,309	2,489,717
26	1,810,914	1,982,276	2,153,035	2,323,138	2,492,534
27	1,813,774	1,985,127	2,155,876	2,325,967	2,495,351
28	1,816,634	1,987,978	2,158,716	2,328,799	2,498,168
29	1,819,495	1,990,829	2,161,556	2,331,625	2,500,984
30	1,822,355	1,993,679	2,164,396	2,334,454	2,503,800

	IO	II	12	13	14
30	1,822,355	1,993,679	2,164,396	2,334,454	2,503,800
31	1,825,215	1,996,530	2,167,236	2,337,282	2,506,626
32	1,828,075	1,999,380	2,170,076	2,340,110	2,509,431
33	1,830,935	2,002,230	2,172,916	2,342,938	2,512,248
34	1,833,795	2,005,080	2,175,755	2,345,766	2,515,064
35	1,836,654	2,007,930	2,178,594	2,348,594	2,517,879
36	1,839,513	2,010,780	2,181,433	2,351,421	2,520,694
37	1,842,372	2,013,629	2,184,272	2,354,248	2,523,509
38	1,845,231	2,016,478	2,187,111	2,357,075	2,526,324
39	1,848,090	2,019,327	2,189,949	2,359,902	2,529,138
40	1,850,949	2,022,176	2,192,787	2,362,729	2,531,952
41	1,853,808	2,025,025	2,195,625	2,365,555	2,534,766
42	1,856,666	2,027,874	2,198,463	2,368,381	2,537,580
43	1,859,524	2,030,722	2,201,300	2,371,207	2,540,393
44	1,862,382	2,033,570	2,204,137	2,374,033	2,543,206
45	1,865,240	2,036,418	2,206,974	2,376,859	2,546,019
46	1,868,098	2,039,266	2,209,811	2,379,684	2,548,832
47	1,870,956	2,042,114	2,212,648	2,382,509	2,551,645
48	1,873,813	2,044,962	2,215,485	2,385,334	2,554,458
49	1,876,670	2,047,809	2,218,322	2,388,159	2,557,270
50	1,879,527	2,050,656	2,221,158	2,390,983	2,560,082
51	1,882,384	2,053,503	2,223,994	2,393,808	2,562,894
52	1,885,241	2,056,350	2,226,830	2,396,632	2,565,706
53	1,888,098	2,059,197	2,229,666	2,399,456	2,568,517
54	1,890,954	2,062,043	2,232,502	2,402,280	2,571,328
55	1,893,810	2,064,889	2,235,337	2,405,104	2,574,139
56	1,896,666	2,067,735	2,238,172	2,407,927	2,576,950
57	1,899,522	2,070,581	2,241,007	2,410,750	2,579,760
58	1,902,378	2,073,427	2,243,842	2,413,573	2,582,570
59	1,905,234	2,076,272	2,246,677	2,416,396	2,585,380
60	1,908,090	2,079,117	2,249,511	2,419,219	2,588,190

	15	16	17	18	19
0	2,588,190	2,756,373	2,923,717	3,090,170	3,255,682
1	2,591,000	2,759,169	2,926,499	3,092,936	3,258,432
2	2,593,809	2,761,965	2,929,280	3,095,702	3,261,182
3	2,596,618	2,764,761	2,932,061	3,098,468	3,263,931
4	2,599,427	2,767,556	2,934,842	3,101,234	3,266,681
5	2,602,236	2,770,351	2,937,623	3,103,999	3,269,430
6	2,605,045	2,773,146	2,940,403	3,106,764	3,272,179
7	2,607,853	2,775,941	2,943,183	3,109,529	3,274,927
8	2,610,661	2,778,735	2,945,963	3,112,294	3,277,675
9	2,613,469	2,781,529	2,948,743	3,115,058	3,280,423
10	2,616,277	2,784,323	2,951,523	3,117,822	3,283,171
11	2,619,084	2,787,117	2,954,302	3,120,586	3,285,918
12	2,621,891	2,789,911	2,957,081	3,123,349	3,288,665
13	2,624,698	2,792,704	2,959,860	3,126,112	3,291,412
14	2,627,505	2,795,497	2,962,630	3,128,875	3,294,159
15	2,630,312	2,798,290	2,965,416	3,131,638	3,296,906
16	2,633,118	2,801,082	2,968,194	3,134,400	3,299,652
17	2,635,924	2,803,874	2,970,972	3,137,162	3,302,398
18	2,638,730	2,806,666	2,973,750	3,139,924	3,305,144
19	2,641,536	2,809,458	2,976,527	3,142,686	3,307,889
20	2,644,342	2,812,250	2,979,304	3,145,448	3,310,634
21	2,647,147	2,815,041	2,982,081	3,148,209	3,313,379
22	2,649,952	2,817,832	2,984,857	3,150,970	3,316,123
23	2,652,757	2,820,623	2,987,633	3,153,731	3,318,867
24	2,655,562	2,823,414	2,990,409	3,156,491	3,321,611
25	2,658,366	2,826,244	2,993,185	3,159,251	3,324,355
26	2,661,170	2,828,994	2,995,960	3,162,011	3,327,098
27	2,663,974	2,831,784	2,998,735	3,164,770	3,329,841
28	2,666,777	2,834,574	3,001,510	3,167,529	3,332,585
29	2,669,580	2,837,364	3,004,284	3,170,288	3,335,327
30	2,672,383	2,840,153	3,007,058	3,173,047	3,338,069

	15	16	17	18	19
30	2,672,383	2,840,153	3,007,058	3,173,047	3,338,069
31	2,675,186	2,842,942	3,009,832	3,175,805	3,340,811
32	2,677,989	2,845,731	3,012,606	3,178,563	3,343,553
33	2,680,792	2,848,520	3,015,380	3,181,321	3,346,294
34	2,683,595	2,851,308	3,018,153	3,184,079	3,349,035
35	2,686,397	2,854,096	3,020,926	3,186,837	3,351,776
36	2,689,199	2,856,884	3,023,699	3,189,594	3,354,516
37	2,692,001	2,859,672	3,026,472	3,192,351	3,357,256
38	2,694,802	2,862,459	3,029,244	3,195,108	3,359,996
39	2,697,603	2,865,246	3,032,016	3,197,864	3,362,736
40	2,700,404	2,868,033	3,034,788	3,200,620	3,365,475
41	2,703,205	2,870,819	3,037,559	3,203,375	3,368,214
42	2,706,005	2,873,605	3,040,330	3,206,130	3,370,953
43	2,708,805	2,876,391	3,043,101	3,208,885	3,373,691
44	2,711,605	2,879,177	3,045,872	3,211,640	3,376,429
45	2,714,405	2,881,963	3,048,643	3,214,395	3,379,167
46	2,717,204	2,884,748	3,051,413	3,217,150	3,381,905
47	2,720,003	2,887,533	3,054,183	3,219,904	3,384,642
48	2,722,802	2,890,318	3,056,953	3,222,658	3,387,379
49	2,725,601	2,893,103	3,059,723	3,225,412	3,390,116
50	2,728,400	2,895,888	3,062,492	3,228,165	3,392,852
51	2,731,198	2,898,672	3,065,261	3,230,918	3,395,588
52	2,733,996	2,901,456	3,068,030	3,233,671	3,398,324
53	2,736,794	2,904,240	3,070,798	3,236,423	3,401,060
54	2,739,592	2,907,023	3,073,566	3,239,175	3,403,795
55	2,742,389	2,909,806	3,076,334	3,241,927	3,406,530
56	2,745,186	2,912,589	3,079,102	3,244,679	3,409,265
57	2,747,983	2,915,371	3,081,869	3,247,430	3,411,999
58	2,750,780	2,918,153	3,084,636	3,250,181	3,414,733
59	2,753,577	2,920,935	3,087,403	3,252,932	3,417,467
60	2,756,373	2,923,717	3,090,170	3,255,682	3,420,201

	20	21	22	23	24
0	3,420,201	3,583,679	3,746,066	3,907,311	4,067,366
1	3,422,934	3,586,395	3,748,763	3,909,989	4,070,023
2	3,425,667	3,589,110	3,751,460	3,912,666	4,072,680
3	3,428,400	3,591,825	3,754,156	3,915,343	4,075,337
4	3,431,133	3,594,540	3,756,852	3,918,020	4,077,993
5	3,433,865	3,597,254	3,759,548	3,920,696	4,080,649
6	3,436,597	3,599,968	3,762,243	3,923,372	4,083,305
7	3,439,329	3,602,682	3,764,938	3,926,048	4,085,960
8	3,442,060	3,605,395	3,767,633	3,928,723	4,088,615
9	3,444,791	3,608,108	3,770,327	3,931,398	4,091,269
10	3,447,522	3,610,821	3,773,021	3,934,072	4,093,923
11	3,450,253	3,613,533	3,775,715	3,936,746	4,096,577
12	3,452,983	3,616,245	3,778,408	3,939,420	4,099,231
13	3,455,713	3,618,957	3,781,101	3,942,093	4,101,884
14	3,458,442	3,621,669	3,783,794	3,944,766	4,104,537
15	3,461,171	3,624,380	3,786,486	3,947,439	4,107,189
16	3,463,900	3,627,091	3,789,178	3,950,112	4,109,841
17	3,466,629	3,629,802	3,791,870	3,952,784	4,112,493
18	3,469,357	3,632,512	3,794,562	3,955,456	4,115,144
19	3,472,085	3,635,222	3,797,253	3,958,128	4,117,795
20	3,474,813	3,637,932	3,799,944	3,960,799	4,120,446
21	3,477,540	3,640,642	3,802,635	3,963,470	4,123,096
22	3,480,267	3,643,351	3,805,325	3,966,140	4,125,746
23	3,482,994	3,646,060	3,808,015	3,968,810	4,128,395
24	3,485,721	3,648,768	3,810,704	3,971,480	4,131,044
25	3,488,447	3,651,476	3,813,393	3,974,149	4,133,693
26	3,491,173	3,654,184	3,816,082	3,976,818	4,136,341
27	3,493,899	3,656,892	3,818,771	3,979,487	4,138,989
28	3,496,624	3,659,599	3,821,459	3,982,155	4,141,637
29	3,499,343	3,662,306	3,824,147	3,984,823	4,144,285
30	3,502,075	3,665,012	3,826,834	3,987,491	4,146,932

	20	21	22	23	24
30	3,502,075	3,665,012	3,826,834	3,987,491	4,146,932
31	3,504,799	3,667,718	3,829,521	3,990,159	4,149,579
32	3,507,523	3,670,424	3,832,208	3,992,826	4,152,226
33	3,510,247	3,673,130	3,834,895	3,995,493	4,154,872
34	3,512,971	3,675,835	3,837,581	3,998,159	4,157,518
35	3,515,694	3,678,541	3,840,267	4,000,825	4,160,163
36	3,518,417	3,681,246	3,842,953	4,003,491	4,162,808
37	3,521,140	3,683,951	3,845,638	4,006,156	4,165,453
38	3,523,862	3,686,655	3,848,323	4,008,821	4,168,097
39	3,526,584	3,689,359	3,851,008	4,011,486	4,170,741
40	3,529,306	3,692,062	3,853,692	4,014,150	4,173,385
41	3,532,027	3,694,765	3,856,376	4,016,814	4,176,028
42	3,534,748	3,697,468	3,859,060	4,019,478	4,178,671
43	3,537,469	3,700,170	3,861,743	4,022,141	4,181,313
44	3,540,190	3,702,872	3,864,426	4,024,804	4,183,955
45	3,542,910	3,705,574	3,867,109	4,027,467	4,186,597
46	3,545,630	3,708,276	3,869,791	4,030,130	4,189,239
47	3,548,350	3,710,977	3,872,473	4,032,792	4,191,880
48	3,551,070	3,713,678	3,875,155	4,035,454	4,194,521
49	3,553,789	3,716,379	3,877,837	4,038,115	4,197,162
50	3,556,508	3,719,080	3,880,518	4,040,776	4,199,802
51	3,559,227	3,721,780	3,883,199	4,043,437	4,202,442
52	3,561,945	3,724,480	3,885,880	4,046,097	4,205,081
53	3,564,663	3,727,179	3,888,560	4,048,757	4,207,720
54	3,567,380	3,729,878	3,891,240	4,051,416	4,210,359
55	3,570,097	3,732,577	3,893,919	4,054,075	4,212,997
56	3,572,814	3,735,275	3,896,598	4,056,734	4,215,635
57	3,575,531	3,737,973	3,899,277	4,059,392	4,218,273
58	3,578,247	3,740,671	3,901,955	4,062,050	4,220,910
59	3,580,963	3,743,369	3,904,633	4,064,708	4,223,547
60	3,583,679	3,746,066	3,907,311	4,067,366	4,226,183

	25	26	27	28	29
0	4,226,183	4,383,712	4,539,905	4,694,716	4,848,096
1	4,228,819	4,386,326	4,542,497	4,697,284	4,850,649
2	4,231,455	4,388,940	4,545,088	4,699,852	4,853,184
3	4,234,090	4,391,554	4,547,679	4,702,419	4,855,727
4	4,236,725	4,394,167	4,549,270	4,704,986	4,858,270
5	4,239,360	4,396,780	4,552,860	4,707,553	4,860,812
6	4,241,994	4,399,392	4,555,450	4,710,119	4,863,354
7	4,244,628	4,402,004	4,558,039	4,712,685	4,865,895
8	4,247,262	4,404,616	4,560,628	4,715,250	4,868,436
9	4,249,895	4,407,227	4,563,216	4,717,815	4,870,977
10	4,252,528	4,409,838	4,565,804	4,720,380	4,873,517
11	4,255,161	4,412,449	4,568,392	4,722,944	4,876,057
12	4,257,793	4,415,059	4,570,979	4,725,508	4,878,596
13	4,260,425	4,417,669	4,573,566	4,728,071	4,881,135
14	4,263,056	4,420,278	4,576,153	4,730,634	4,883,674
15	4,265,687	4,422,887	4,578,739	4,733,197	4,886,212
16	4,268,318	4,425,496	4,581,325	4,735,759	4,888,750
17	4,270,949	4,428,104	4,583,911	4,738,321	4,891,287
18	4,273,579	4,430,712	4,586,496	4,740,882	4,893,824
19	4,276,209	4,433,320	4,589,081	4,743,443	4,896,361
20	4,278,838	4,435,927	4,591,665	4,746,004	4,898,897
21	4,281,467	4,438,534	4,594,249	4,748,564	4,901,433
22	4,284,096	4,441,140	4,596,833	4,751,124	4,903,968
23	4,286,724	4,443,746	4,599,416	4,753,683	4,906,503
24	4,289,352	4,446,352	4,601,999	4,756,242	4,909,037
25	4,291,979	4,448,957	4,604,581	4,758,801	4,911,571
26	4,294,606	4,451,562	4,607,163	4,761,359	4,914,105
27	4,297,233	4,454,167	4,609,744	4,763,917	4,916,638
28	4,299,859	4,456,771	4,612,325	4,766,474	4,919,171
29	4,302,485	4,459,375	4,614,906	4,769,031	4,921,703
30	4,305,111	4,461,978	4,617,486	4,771,588	4,924,235

	25	26	27	28	29
30	4,305,111	4,461,978	4,617,486	4,771,588	4,924,235
31	4,307,736	4,464,581	4,620,066	4,774,144	4,926,767
32	4,310,361	4,467,184	4,622,646	4,776,700	4,929,298
33	4,312,986	4,469,786	4,625,225	4,779,255	4,931,829
34	4,315,610	4,472,388	4,627,804	4,781,810	4,934,359
35	4,318,234	4,474,990	4,630,382	4,784,365	4,936,889
36	4,320,858	4,477,591	4,632,960	4,786,919	4,939,418
37	4,323,481	4,480,192	4,635,538	4,789,473	4,941,947
38	4,326,104	4,482,792	4,638,115	4,792,026	4,944,476
39	4,328,726	4,485,392	4,640,692	4,794,579	4,947,004
40	4,331,348	4,487,992	4,643,268	4,797,132	4,949,532
41	4,333,970	4,490,591	4,645,844	4,799,684	4,952,059
42	4,336,591	4,493,190	4,648,420	4,802,236	4,954,586
43	4,339,212	4,495,788	4,650,995	4,804,787	4,957,113
44	4,341,833	4,498,386	4,653,570	4,807,338	4,959,639
45	4,344,453	4,500,984	4,656,145	4,809,888	4,962,165
46	4,347,073	4,503,582	4,658,719	4,812,438	4,964,690
47	4,349,693	4,506,179	4,661,293	4,814,988	4,967,215
48	4,352,312	4,508,776	4,663,866	4,817,537	4,969,740
49	4,354,931	4,511,372	4,666,439	4,820,086	4,972,264
50	4,357,549	4,513,968	4,669,012	4,822,635	4,974,788
51	4,360,167	4,516,563	4,671,584	4,825,183	4,977,311
52	4,362,785	4,519,158	4,674,156	4,827,731	4,979,834
53	4,365,402	4,521,753	4,676,727	4,830,278	4,982,356
54	4,368,019	4,524,347	4,679,298	4,832,825	4,984,878
55	4,370,635	4,526,941	4,681,869	4,835,371	4,987,399
56	4,373,251	4,529,535	4,684,439	4,837,917	4,989,920
57	4,375,867	4,532,128	4,687,009	4,840,462	4,992,441
58	4,378,482	4,534,721	4,689,578	4,843,007	4,994,961
59	4,381,097	4,537,313	4,692,147	4,845,552	4,997,481
60	4,383,712	4,539,905	4,694,716	4,848,096	5,000,000

	30	31	32	33	34
0	5,000,000	5,150,381	5,299,192	5,446,390	5,591,929
1	5,002,519	5,152,874	5,301,659	5,448,829	5,594,340
2	5,005,038	5,155,367	5,304,125	5,451,268	5,596,751
3	5,007,556	5,157,859	5,306,591	5,453,707	5,599,161
4	5,010,074	5,160,351	5,309,056	5,456,145	5,601,571
5	5,012,591	5,162,843	5,311,521	5,458,583	5,603,981
6	5,015,108	5,165,334	5,313,985	5,461,020	5,606,390
7	5,017,624	5,167,825	5,316,449	5,463,456	5,608,798
8	5,020,140	5,170,315	5,318,913	5,465,892	5,611,206
9	5,022,656	5,172,805	5,321,376	5,468,328	5,613,614
10	5,025,171	5,175,294	5,323,839	5,470,763	5,616,021
11	5,027,686	5,177,783	5,326,301	5,473,198	5,618,427
12	5,030,200	5,180,271	5,328,763	5,475,632	5,620,833
13	5,032,714	5,182,759	5,331,224	5,478,066	5,623,239
14	5,035,227	5,185,246	5,333,685	5,480,499	5,625,644
15	5,037,740	5,187,733	5,336,145	5,482,932	5,628,049
16	5,040,253	5,190,220	5,338,605	5,485,364	5,630,453
17	5,042,765	5,192,706	5,341,065	5,487,796	5,632,857
18	5,045,277	5,195,192	5,343,524	5,490,228	5,635,260
19	5,047,788	5,197,677	5,345,983	5,492,659	5,637,663
20	5,050,299	5,200,162	5,348,441	5,495,090	5,640,066
21	5,052,809	5,202,646	5,350,898	5,497,520	5,642,468
22	5,055,319	5,205,130	5,353,355	5,499,950	5,644,869
23	5,057,829	5,207,614	5,355,812	5,502,379	5,647,270
24	5,060,338	5,210,097	5,358,268	5,504,808	5,649,670
25	5,062,847	5,212,580	5,360,724	5,507,236	5,652,070
26	5,065,355	5,215,062	5,363,179	5,509,664	5,654,469
27	5,067,863	5,217,544	5,365,634	5,512,091	5,656,868
28	5,070,370	5,220,025	5,368,088	5,514,518	5,659,266
29	5,072,877	5,222,506	5,370,542	5,516,944	5,661,664
30	5,075,384	5,224,986	5,372,996	5,519,370	5,664,062

	30	31.	32	33	34
30	5,075,384	5,224,980	5,372,990	5,519,370	5,664,062
31	5,077,890	5,227,460	5,375,449	5,521,795	5,666,459
32	5,080,396	5,229,940	5,377,902	5,524,220	5,668,856
33	5,082,901	5,232,425	5,380,354	5,526,645	5,671,252
34	5,085,406	5,234,904	5,382,806	5,529,069	5,673,648
35	5,087,911	5,237,382	5,385,258	5,531,493	5,676,043
36	5,090,415	5,239,860	5,387,709	5,533,916	5,678,438
37	5,092,919	5,242,337	5,390,159	5,536,338	5,680,832
38	5,095,422	5,244,814	5,392,609	5,538,760	5,683,226
39	5,097,925	5,247,290	5,395,058	5,541,182	5,685,619
40	5,100,427	5,249,766	5,397,507	5,543,603	5,688,012
41	5,102,929	5,252,241	5,399,955	5,546,024	5,690,404
42	5,105,430	5,254,716	5,402,403	5,548,444	5,692,796
43	5,107,931	5,257,191	5,404,851	5,550,864	5,695,187
44	5,110,431	5,259,665	5,407,298	5,553,283	5,697,578
45	5,112,931	5,262,139	5,409,745	5,555,702	5,699,968
46	5,115,431	5,264,612	5,412,191	5,558,120	5,702,358
47	5,117,930	5,267,085	5,414,637	5,560,538	5,704,747
48	5,120,429	5,269,557	5,417,082	5,562,956	5,707,136
49	5,122,927	5,272,029	5,419,527	5,565,373	5,709,524
50	5,125,425	5,274,501	5,421,972	5,567,790	5,711,912
51	5,127,922	5,276,972	5,424,416	5,570,206	5,714,289
52	5,130,419	5,279,443	5,426,859	5,572,622	5,716,666
53	5,132,916	5,281,913	5,429,302	5,575,037	5,719,072
54	5,135,412	5,284,383	5,431,745	5,577,452	5,721,458
55	5,137,908	5,286,852	5,434,187	5,579,866	5,723,844
56	5,140,403	5,299,321	5,436,629	5,582,280	5,726,229
57	5,142,898	5,291,789	5,439,070	5,584,693	5,728,613
58	5,145,393	5,294,257	5,441,510	5,587,106	5,730,997
59	5,147,887	5,296,725	5,443,950	5,589,518	5,733,381
60	5,150,381	5,299,192	5,446,390	5,591,929	5,735,764

	35	36	37	38	39
0	5,735,764	5,877,852	6,018,150	6,156,615	6,293,204
1	5,738,147	5,880,205	6,020,473	6,158,907	6,295,464
2	5,740,529	5,882,558	6,022,796	6,161,198	6,297,724
3	5,742,911	5,884,910	6,025,118	6,163,489	6,299,983
4	5,745,292	5,887,262	6,027,439	6,165,781	6,302,242
5	5,747,672	5,889,613	6,029,760	6,168,070	6,304,501
6	5,750,052	5,891,964	6,032,080	6,170,259	6,306,759
7	5,752,432	5,894,314	6,034,400	6,172,648	6,309,016
8	5,754,811	5,896,664	6,036,719	6,174,936	6,311,273
9	5,757,190	5,899,013	6,039,038	6,177,224	6,313,529
10	5,759,568	5,901,361	6,041,357	6,179,512	6,315,784
11	5,761,946	5,903,709	6,043,675	6,181,799	6,318,039
12	5,764,323	5,906,056	6,045,992	6,184,085	6,320,293
13	5,766,700	5,908,403	6,048,309	6,186,371	6,322,547
14	5,769,076	5,910,750	6,050,625	6,188,656	6,324,800
15	5,771,452	5,913,096	6,052,940	6,190,940	6,327,053
16	5,773,827	5,915,442	6,055,255	6,193,224	6,329,305
17	5,776,202	5,917,787	6,057,570	6,195,508	6,331,557
18	5,778,576	5,920,132	6,059,884	6,197,791	6,333,808
19	5,780,950	5,922,476	6,062,198	6,200,074	6,336,059
20	5,783,324	5,924,820	6,064,511	6,202,356	6,338,310
21	5,785,697	5,927,163	6,066,824	6,204,638	6,340,560
22	5,788,069	5,929,505	6,069,136	6,206,919	6,342,809
23	5,790,441	5,931,847	6,071,448	6,209,199	6,345,058
24	5,792,812	5,934,189	6,073,759	6,211,479	6,347,309
25	5,795,183	5,936,530	6,076,069	6,213,758	6,349,553
26	5,797,553	5,938,871	6,078,379	6,216,037	6,351,800
27	5,799,923	5,941,211	6,080,688	6,218,315	6,354,046
28	5,802,292	5,943,551	6,082,997	6,220,593	6,356,292
29	5,804,661	5,945,890	6,085,306	6,222,870	6,358,537
30	5,807,030	5,948,228	6,087,614	6,225,146	6,360,782

	35	36	37	38	39
30	5,807,030	5,948,228	6,087,614	6,225,146	6,360,782
31	5,809,398	5,950,566	6,089,922	6,227,422	6,363,026
32	5,811,766	5,952,904	6,092,229	6,229,698	6,365,270
33	5,814,133	5,955,241	6,094,536	6,231,973	6,367,513
34	5,816,499	5,957,578	6,096,842	6,234,248	6,369,756
35	5,818,865	5,959,914	6,099,147	6,236,522	6,371,999
36	5,821,230	5,962,250	6,101,452	6,238,796	6,374,241
37	5,823,595	5,964,585	6,103,756	6,241,069	6,376,482
38	5,825,959	5,966,919	6,106,060	6,243,342	6,378,722
39	5,828,323	5,969,253	6,108,364	6,245,614	6,380,962
40	5,830,687	5,971,586	6,110,667	6,247,885	6,383,201
41	5,833,050	5,973,919	6,112,970	6,250,156	6,385,440
42	5,835,412	5,976,251	6,115,272	6,252,426	6,387,678
43	5,837,774	5,978,583	6,117,573	6,254,696	6,389,916
44	5,840,136	5,980,915	6,119,873	6,256,966	6,392,153
45	5,842,497	5,983,246	6,122,173	6,259,235	6,394,390
46	5,844,858	5,985,577	6,124,473	6,261,503	6,396,626
47	5,847,218	5,987,907	6,126,772	6,263,771	6,398,862
48	5,849,578	5,990,237	6,129,071	6,266,038	6,401,097
49	5,851,937	5,992,566	6,131,369	6,268,305	6,403,332
50	5,854,295	5,994,894	6,133,667	6,270,572	6,405,566
51	5,856,653	5,997,222	6,135,964	6,272,838	6,407,799
52	5,859,010	5,999,549	6,138,261	6,275,103	6,410,032
53	5,861,367	6,001,876	6,140,557	6,277,368	6,412,264
54	5,863,724	6,004,202	6,142,853	6,279,632	6,414,496
55	5,866,080	6,006,528	6,145,148	6,281,895	6,416,728
56	5,868,436	6,008,853	6,147,442	6,284,158	6,418,959
57	5,870,791	6,011,178	6,149,746	6,286,420	6,421,189
58	5,873,145	6,013,502	6,152,030	6,288,682	6,423,419
59	5,875,499	6,015,826	6,154,323	6,290,943	6,425,648
60	5,877,852	6,018,150	6,156,615	6,293,204	6,427,876

	40	41	42	43	44
0	6,427,876	6,560,590	6,691,306	6,819,984	6,946,584
1	6,430,104	6,562,785	6,693,468	6,822,111	6,948,676
2	6,432,331	6,564,979	6,695,629	6,824,237	6,950,767
3	6,434,558	6,567,173	6,697,789	6,826,363	6,952,858
4	6,436,785	6,569,367	6,699,949	6,828,489	6,954,949
5	6,439,011	6,571,560	6,702,108	6,830,614	6,957,039
6	6,441,236	6,573,753	6,704,267	6,832,738	6,959,128
7	6,443,461	6,575,945	6,706,425	6,834,861	6,961,216
8	6,445,685	6,578,136	6,708,582	6,836,984	6,963,304
9	6,447,909	6,580,326	6,710,739	6,839,107	6,965,392
10	6,450,132	6,582,516	6,712,895	6,841,229	6,967,479
11	6,452,355	6,584,705	6,715,051	6,843,350	6,969,565
12	6,454,577	6,586,894	6,717,206	6,845,471	6,971,651
13	6,456,799	6,589,082	6,719,361	6,847,591	6,973,736
14	6,459,020	6,591,270	6,721,515	6,849,711	6,975,821
15	6,461,240	6,593,458	6,723,668	6,851,830	6,977,905
16	6,463,460	6,595,645	6,725,821	6,853,949	6,979,988
17	6,465,679	6,597,831	6,727,973	6,856,067	6,982,071
18	6,467,898	6,600,016	6,730,125	6,858,184	6,984,153
19	6,470,116	6,602,201	6,732,276	6,860,301	6,986,235
20	6,472,333	6,604,386	6,734,427	6,862,417	6,988,316
21	6,474,550	6,606,570	6,736,577	6,864,533	6,990,396
22	6,476,766	6,608,753	6,738,726	6,866,648	6,992,476
23	6,478,982	6,610,936	6,740,875	6,868,762	6,994,555
24	6,481,198	6,613,118	6,743,024	6,870,876	6,996,634
25	6,483,413	6,615,300	6,745,172	6,872,989	6,998,712
26	6,485,628	6,617,481	6,747,319	6,875,102	7,000,789
27	6,487,842	6,619,661	6,749,465	6,877,214	7,002,866
28	6,490,055	6,621,841	6,751,611	6,879,325	7,004,942
29	6,492,268	6,624,021	6,753,757	6,881,436	7,007,018
30	6,494,480	6,626,200	6,755,902	6,883,546	7,009,093

	40	41	42	43	44
30	6,494,480	6,626,200	6,755,902	6,883,546	7,009,093
31	6,496,692	6,628,379	6,758,047	6,885,656	7,011,167
32	6,498,903	6,630,557	6,760,191	6,887,765	7,013,241
33	6,501,114	6,632,734	6,762,334	6,889,874	7,015,314
34	6,503,324	6,634,911	6,764,477	6,891,982	7,017,387
35	6,505,533	6,637,087	6,766,619	6,894,089	7,019,459
36	6,507,742	6,639,263	6,768,760	6,896,196	7,021,530
37	6,509,950	6,641,438	6,770,901	6,898,302	7,023,601
38	6,512,158	6,643,612	6,773,041	6,900,408	7,025,671
39	6,514,365	6,645,786	6,775,181	6,902,513	7,027,741
40	6,516,572	6,647,959	6,777,320	6,904,617	7,029,810
41	6,518,778	6,650,132	6,779,459	6,906,721	7,031,879
42	6,520,984	6,652,304	6,781,597	6,908,824	7,033,947
43	6,523,189	6,654,476	6,783,734	6,910,927	7,036,014
44	6,525,394	6,656,647	6,785,971	6,913,029	7,038,081
45	6,527,598	6,658,817	6,788,007	6,915,131	7,040,147
46	6,529,801	6,660,987	6,790,143	6,917,232	7,042,213
47	6,532,004	6,663,156	6,792,278	6,919,332	7,044,278
48	6,534,206	6,665,325	6,794,413	6,921,432	7,046,342
49	6,536,408	6,667,493	6,796,547	6,923,531	7,048,406
50	6,538,609	6,669,661	6,798,681	6,925,630	7,050,469
51	6,540,809	6,671,828	6,800,814	6,927,728	7,052,532
52	6,543,009	6,673,994	6,802,946	6,929,825	7,054,594
53	6,545,208	6,676,160	6,805,078	6,931,922	7,056,655
54	6,547,407	6,678,326	6,807,209	6,934,018	7,058,716
55	6,549,606	6,680,491	6,809,340	6,936,114	7,060,776
56	6,551,804	6,682,655	6,811,470	6,938,209	7,062,836
57	6,554,001	6,684,818	6,813,599	6,940,303	7,064,895
58	6,556,198	6,686,981	6,815,728	6,942,397	7,066,953
59	6,558,394	6,689,144	6,817,856	6,944,491	7,069,011
60	6,560,590	6,691,306	6,819,984	6,946,584	7,071,068

	45	46	47	48	49
0	7,071,068	7,193,398	7,313,537	7,431,448	7,547,096
1	7,073,125	7,195,418	7,315,521	7,433,394	7,549,004
2	7,075,181	7,197,438	7,317,504	7,435,339	7,550,911
3	7,077,236	7,199,457	7,319,486	7,437,284	7,552,818
4	7,079,291	7,201,476	7,321,468	7,439,229	7,554,724
5	7,081,345	7,203,494	7,323,449	7,441,173	7,556,630
6	7,083,399	7,205,511	7,325,429	7,443,116	7,558,535
7	7,085,452	7,207,527	7,327,409	7,445,058	7,560,439
8	7,087,504	7,209,543	7,329,388	7,447,000	7,562,343
9	7,089,556	7,211,559	7,331,367	7,448,941	7,564,246
10	7,091,607	7,213,574	7,333,345	7,450,882	7,566,148
11	7,093,658	7,215,588	7,335,322	7,452,822	7,568,050
12	7,095,708	7,217,601	7,337,298	7,454,761	7,569,951
13	7,097,757	7,219,614	7,339,274	7,456,699	7,571,851
14	7,099,806	7,221,627	7,341,250	7,458,637	7,573,751
15	7,101,854	7,223,639	7,343,225	7,460,574	7,575,650
16	7,103,902	7,225,651	7,345,199	7,462,511	7,577,548
17	7,105,949	7,227,662	7,347,173	7,464,447	7,579,446
18	7,107,995	7,229,672	7,349,145	7,466,382	7,581,343
19	7,110,041	7,231,681	7,351,118	7,468,317	7,583,240
20	7,112,086	7,233,689	7,353,090	7,470,251	7,585,136
21	7,114,131	7,235,697	7,355,061	7,472,184	7,587,031
22	7,116,175	7,237,704	7,357,031	7,474,117	7,588,925
23	7,118,218	7,239,711	7,359,001	7,476,049	7,590,819
24	7,120,261	7,241,718	7,360,970	7,477,981	7,592,713
25	7,122,303	7,243,724	7,362,939	7,479,912	7,594,606
26	7,124,344	7,245,729	7,364,907	7,481,842	7,596,498
27	7,126,385	7,247,733	7,366,874	7,483,771	7,598,389
28	7,128,425	7,249,737	7,368,841	7,485,700	7,600,280
29	7,130,465	7,251,741	7,370,807	7,487,629	7,602,170
30	7,132,504	7,253,744	7,372,773	7,489,557	7,604,060

	45	46	47	48	49
30	7,132,504	7,253,744	7,372,773	7,489,557	7,604,060
31	7,134,543	7,255,746	7,374,738	7,491,484	7,605,949
32	7,136,581	7,257,747	7,376,702	7,493,410	7,607,837
33	7,138,618	7,259,748	7,378,666	7,495,336	7,609,725
34	7,140,655	7,261,749	7,380,629	7,497,262	7,611,612
35	7,142,691	7,263,749	7,382,592	7,499,187	7,613,498
36	7,144,727	7,265,748	7,384,554	7,501,111	7,615,384
37	7,146,762	7,267,746	7,386,515	7,503,034	7,617,269
38	7,148,796	7,269,744	7,388,475	7,504,957	7,619,153
39	7,150,830	7,271,741	7,390,435	7,506,879	7,621,037
40	7,152,863	7,273,737	7,392,394	7,508,801	7,622,920
41	7,154,895	7,275,733	7,394,353	7,510,722	7,624,802
42	7,156,927	7,277,728	7,396,311	7,512,642	7,626,683
43	7,158,958	7,279,722	7,398,268	7,514,561	7,628,564
44	7,160,989	7,281,716	7,400,225	7,516,480	7,630,445
45	7,163,019	7,283,710	7,402,181	7,518,398	7,632,325
46	7,165,049	7,285,703	7,404,137	7,520,316	7,634,204
47	7,167,078	7,287,695	7,406,092	7,522,233	7,636,082
48	7,169,106	7,289,687	7,408,046	7,524,149	7,637,960
49	7,171,134	7,291,678	7,410,000	7,526,065	7,639,838
50	7,173,161	7,293,668	7,411,953	7,527,980	7,641,715
51	7,175,187	7,295,658	7,413,905	7,529,894	7,643,591
52	7,177,213	7,297,647	7,415,856	7,531,808	7,645,466
53	7,179,238	7,299,635	7,417,807	7,533,721	7,647,341
54	7,181,263	7,301,623	7,419,758	7,535,634	7,649,215
55	7,183,287	7,303,610	7,421,708	7,537,546	7,651,088
56	7,185,310	7,305,597	7,423,657	7,539,457	7,652,961
57	7,187,333	7,307,583	7,425,605	7,541,367	7,654,833
58	7,189,355	7,309,568	7,427,553	7,543,277	7,656,704
59	7,191,377	7,311,553	7,429,501	7,545,187	7,658,575
60	7,193,398	7,313,537	7,431,448	7,547,096	7,660,445

CANON

	50	51	52	53	54
0	7,660,445	7,771,460	7,880,108	7,986,355	8,090,170
1	7,662,314	7,773,290	7,881,898	7,988,105	8,091,879
2	7,664,183	7,775,120	7,883,688	7,989,855	8,093,588
3	7,666,051	7,776,949	7,885,477	7,991,604	8,095,296
4	7,667,919	7,778,777	7,887,266	7,993,352	8,097,004
5	7,669,786	7,780,605	7,889,054	7,995,100	8,098,711
6	7,671,652	7,782,432	7,890,841	7,996,847	8,100,417
7	7,673,517	7,784,258	7,892,627	7,998,593	8,102,122
8	7,675,382	7,786,084	7,894,413	8,000,339	8,104,827
9	7,677,246	7,787,909	7,896,198	8,002,084	8,106,531
10	7,679,110	7,789,733	7,897,983	8,003,828	8,108,234
11	7,680,973	7,791,557	7,899,767	8,005,571	8,110,936
12	7,682,835	7,793,380	7,901,550	8,007,314	8,112,638
13	7,684,687	7,795,202	7,903,332	8,009,056	8,114,339
14	7,686,549	7,797,024	7,905,114	8,010,797	8,116,040
15	7,688,418	7,798,845	7,906,896	8,012,538	8,117,740
16	7,690,278	7,800,665	7,908,676	8,014,278	8,119,439
17	7,692,137	7,802,485	7,910,456	8,016,017	8,121,137
18	7,693,995	7,804,304	7,912,235	8,017,756	8,122,835
19	7,695,853	7,806,123	7,914,014	8,019,494	8,124,532
20	7,697,710	7,807,941	7,915,792	8,021,232	8,126,229
21	7,699,566	7,809,758	7,917,569	8,022,969	8,127,925
22	7,701,422	7,811,574	7,919,345	8,024,705	8,129,620
23	7,703,277	7,813,390	7,921,121	8,026,440	8,131,314
24	7,705,132	7,815,205	7,922,896	8,028,175	8,133,008
25	7,706,986	7,817,020	7,924,671	8,029,909	8,134,701
26	7,708,839	7,818,834	7,926,445	8,031,642	8,136,393
27	7,710,692	7,820,647	7,928,218	8,033,375	8,138,084
28	7,712,544	7,822,459	7,929,990	8,035,107	8,139,775
29	7,714,395	7,824,271	7,931,762	8,036,838	8,141,465
30	7,716,246	7,826,082	7,933,533	8,038,569	8,143,155

	50	51	52	53	54
30	7,716,246	7,826,082	7,933,533	8,038,569	8,141,155
31	7,718,096	7,827,892	7,935,303	8,040,299	8,142,844
32	7,719,945	7,829,702	7,937,073	8,042,028	8,144,532
33	7,721,794	7,831,511	7,938,842	8,043,757	8,146,220
34	7,723,642	7,833,320	7,940,611	8,045,485	8,147,907
35	7,725,490	7,835,128	7,942,379	8,047,212	8,149,593
36	7,727,337	7,836,935	7,944,146	8,048,938	8,151,278
37	7,729,183	7,838,741	7,945,912	8,050,664	8,152,963
38	7,731,028	7,840,547	7,947,678	8,052,389	8,154,647
39	7,732,872	7,842,352	7,949,443	8,054,114	8,156,330
40	7,734,716	7,844,157	7,951,208	8,055,838	8,158,013
41	7,736,559	7,845,961	7,952,972	8,057,561	8,159,695
42	7,738,402	7,847,764	7,954,735	8,059,283	8,161,376
43	7,740,244	7,849,566	7,956,497	8,061,005	8,163,057
44	7,742,085	7,851,368	7,958,259	8,062,726	8,164,737
45	7,743,926	7,853,169	7,960,020	8,064,446	8,166,416
46	7,745,766	7,854,970	7,961,780	8,066,166	8,168,094
47	7,747,606	7,856,770	7,963,540	8,067,885	8,169,772
48	7,749,445	7,858,569	7,965,299	8,069,603	8,171,449
49	7,751,283	7,860,368	7,967,057	8,071,321	8,173,126
50	7,753,121	7,862,166	7,968,815	8,073,038	8,174,802
51	7,754,958	7,863,963	7,970,572	8,074,754	8,176,477
52	7,756,794	7,865,759	7,972,328	8,076,470	8,178,151
53	7,758,630	7,867,555	7,974,084	8,078,185	8,179,825
54	7,760,465	7,869,350	7,975,838	8,079,899	8,181,498
55	7,762,299	7,871,145	7,977,593	8,081,613	8,183,170
56	7,764,132	7,872,939	7,979,347	8,083,326	8,184,841
57	7,765,965	7,874,732	7,981,100	8,085,038	8,186,512
58	7,767,797	7,876,525	7,982,852	8,086,749	8,188,182
59	7,769,629	7,878,317	7,984,604	8,088,460	8,189,851
60	7,771,460	7,880,108	7,986,355	8,090,170	8,191,520

	55	56	57	58	59
0	8,191,520	8,290,376	8,386,706	8,480,481	8,571,673
1	8,193,188	8,292,002	8,388,290	8,482,022	8,573,171
2	8,194,855	8,293,628	8,389,873	8,483,562	8,574,668
3	8,196,522	8,295,253	8,391,456	8,485,102	8,576,164
4	8,198,188	8,296,877	8,393,038	8,486,641	8,577,660
5	8,199,854	8,298,501	8,394,619	8,488,180	8,579,155
6	8,201,519	8,300,124	8,396,199	8,489,718	8,580,649
7	8,203,183	8,301,746	8,397,778	8,491,255	8,582,142
8	8,204,846	8,303,367	8,399,357	8,492,791	8,583,635
9	8,206,508	8,304,987	8,400,935	8,494,326	8,585,127
10	8,208,170	8,306,607	8,402,513	8,495,860	8,586,619
11	8,209,831	8,308,226	8,404,090	8,497,394	8,588,110
12	8,211,491	8,309,844	8,405,666	8,498,927	8,589,600
13	8,213,151	8,311,462	8,407,241	8,500,459	8,591,089
14	8,214,810	8,313,079	8,418,816	8,501,991	8,592,577
15	8,216,469	8,314,696	8,410,390	8,503,522	8,594,064
16	8,218,127	8,316,312	8,411,963	8,505,052	8,595,551
17	8,219,784	8,317,927	8,413,536	8,506,582	8,597,037
18	8,221,440	8,319,541	8,415,108	8,508,111	8,598,523
19	8,223,096	8,321,155	8,416,679	8,509,639	8,600,008
20	8,224,751	8,322,768	8,418,250	8,511,167	8,601,492
21	8,226,405	8,324,380	8,419,820	8,512,694	8,602,975
22	8,228,058	8,325,991	8,421,389	8,514,220	8,604,457
23	8,229,711	8,327,602	8,422,957	8,515,745	8,605,939
24	8,231,363	8,329,212	8,424,525	8,517,270	8,607,420
25	8,233,015	8,330,822	8,426,092	8,518,794	8,608,901
26	8,234,666	8,332,431	8,427,658	8,520,317	8,610,381
27	8,236,316	8,334,039	8,429,223	8,521,839	8,611,860
28	8,237,965	8,335,646	8,430,788	8,523,361	8,613,338
29	8,239,614	8,337,252	8,432,352	8,524,882	8,614,815
30	8,241,262	8,338,858	8,433,915	8,526,402	8,616,292

	55	56	57	58	59
30	8,241,262	8,338,858	8,423,915	8,526,402	8,616,292
31	8,242,909	8,340,463	8,435,477	8,527,921	8,617,768
32	8,244,556	8,342,067	8,437,039	8,529,440	8,619,243
33	8,246,202	8,343,671	8,438,600	8,530,958	8,620,718
34	8,247,847	8,345,274	8,440,161	8,532,476	8,622,192
35	8,249,492	8,346,877	8,441,721	8,533,993	8,623,665
36	8,251,136	8,348,479	8,443,280	8,535,509	8,625,137
37	8,252,779	8,350,080	8,444,838	8,537,024	8,626,608
38	8,254,421	8,351,680	8,446,396	8,538,538	8,628,079
39	8,256,062	8,353,279	8,447,953	8,540,052	8,629,549
40	8,257,703	8,354,878	8,449,509	8,541,565	8,631,019
41	8,249,343	8,356,476	8,451,064	8,543,077	8,732,488
42	8,260,982	8,358,073	8,452,618	8,544,588	8,633,956
43	8,262,621	8,359,670	8,454,172	8,546,096	8,635,423
44	8,264,259	8,361,266	8,455,725	8,547,609	8,636,889
45	8,265,897	8,362,862	8,457,278	8,549,119	8,638,355
46	8,267,534	8,364,457	8,458,830	8,550,628	8,639,820
47	8,269,170	8,366,051	8,460,381	8,552,136	8,641,284
48	8,270,806	8,367,644	8,461,932	8,553,643	8,642,748
49	8,272,441	8,369,236	8,463,482	8,555,149	8,644,211
50	8,274,075	8,370,828	8,465,031	8,556,655	8,645,673
51	8,275,708	8,372,419	8,466,579	8,558,160	8,647,134
52	8,277,340	8,374,009	8,468,126	8,559,664	8,648,595
53	8,278,972	8,375,599	8,469,673	8,561,168	8,650,055
54	8,280,603	8,377,188	8,471,219	8,562,671	8,651,514
55	8,282,234	8,378,776	8,472,765	8,564,173	8,652,973
56	8,283,864	8,380,363	8,474,310	8,565,675	8,654,431
57	8,285,493	8,381,950	8,475,854	8,567,176	8,655,888
58	8,287,121	8,383,536	8,477,297	8,568,676	8,657,344
59	8,288,794	8,385,121	8,478,939	8,570,175	8,658,799
60	8,290,376	8,386,706	8,480,481	8,571,673	8,660,254

	60	61	62	63	64
0	8,660,254	8,746,197	8,829,476	8,910,065	8,987,946
1	8,661,708	8,747,607	8,830,841	8,911,385	8,989,215
2	8,663,162	8,749,016	8,832,205	8,912,704	8,990,489
3	8,664,615	8,750,425	8,833,569	8,914,023	8,991,762
4	8,666,067	8,751,833	8,834,932	8,915,341	8,993,035
5	8,667,518	8,753,240	8,836,295	8,916,659	8,994,307
6	8,668,968	8,754,646	8,837,657	8,917,976	8,995,578
7	8,670,417	8,756,051	8,839,018	8,919,292	8,996,848
8	8,671,866	8,757,456	8,840,378	8,920,607	8,998,117
9	8,673,314	8,758,860	8,841,737	8,921,921	8,999,386
10	8,674,762	8,760,263	8,843,095	8,923,234	9,000,654
11	8,676,209	8,761,665	8,844,452	8,924,546	9,001,921
12	8,677,655	8,763,068	8,845,809	8,925,858	9,003,187
13	8,679,100	8,764,468	8,847,165	8,927,169	9,004,453
14	8,680,544	8,765,868	8,848,521	8,928,479	9,005,718
15	8,681,988	8,767,267	8,849,876	8,929,789	9,006,982
16	8,683,431	8,768,667	8,851,230	8,931,098	9,008,245
17	8,684,873	8,670,065	8,852,583	8,932,406	9,009,508
18	8,686,316	8,771,462	8,853,936	8,933,717	9,010,770
19	8,687,757	8,772,859	8,855,288	8,935,021	9,012,031
20	8,689,197	8,774,255	8,856,639	8,936,327	9,013,292
21	8,690,636	8,775,650	8,857,989	8,937,632	9,014,552
22	8,692,074	8,777,044	8,859,338	8,938,936	9,015,811
23	8,693,512	8,778,437	8,860,687	8,940,240	9,017,069
24	8,694,949	8,779,830	8,862,035	8,941,543	9,018,326
25	8,696,386	8,781,222	8,863,383	8,942,845	9,019,582
26	8,697,822	8,782,613	8,864,730	8,944,146	9,020,838
27	8,699,257	8,784,003	8,866,076	8,945,446	9,022,093
28	8,700,691	8,785,393	8,867,421	8,946,746	9,023,347
29	8,702,124	8,786,782	8,868,765	8,948,045	9,024,600
30	8,703,557	8,788,171	8,870,108	8,949,344	9,025,853

S I N V V M.						163
64	60	61	62	63	64	
65 8,987,340	30 8,703,557	8,788,171	8,870,108	8,949,344	9,025,853	
85 8,989,310	31 8,704,989	8,789,559	8,871,451	8,950,642	9,027,105	
704 8,999,400	32 8,706,420	8,790,946	8,872,793	8,951,939	9,028,356	
23 8,991,700	33 8,707,851	8,792,332	8,874,134	8,953,235	9,029,606	
341 8,993,700	34 8,709,281	8,793,717	8,875,475	8,954,530	9,030,856	
659 8,994,700	35 8,710,710	8,795,102	8,876,815	8,955,824	9,032,105	
970 8,995,700	36 8,712,138	8,796,486	8,878,154	8,957,117	9,033,353	
232 8,996,700	37 8,713,565	8,797,869	8,879,492	8,958,410	9,034,600	
2007 8,998,700	38 8,714,992	8,799,251	8,880,830	8,959,702	9,035,847	
121 8,999,700	39 8,716,418	8,800,633	8,882,167	8,960,994	9,037,093	
3,334 9,000,700	40 8,717,844	8,802,014	8,883,503	8,962,285	9,038,338	
4,546 9,001,700	41 8,719,269	8,803,394	8,884,838	8,963,575	9,039,582	
5,588 9,002,700	42 8,720,693	8,804,773	8,886,172	8,964,864	9,040,825	
7,269 9,003,700	43 8,722,116	8,806,152	8,887,506	8,966,152	9,042,068	
8,479 9,004,700	44 8,723,538	8,807,530	8,888,839	8,967,440	9,043,310	
9,789 9,005,700	45 8,724,960	8,808,907	8,890,171	8,968,727	9,044,551	
1,098 9,006,700	46 8,726,381	8,810,285	8,891,502	8,970,013	9,045,791	
1,406 9,007,700	47 8,727,801	8,811,659	8,892,833	8,971,299	9,047,031	
3,717 9,008,700	48 8,729,221	8,813,034	8,894,163	8,972,584	9,048,270	
5,021 9,009,700	49 8,730,640	8,814,408	8,895,492	8,973,868	9,049,508	
6,327 9,010,700	50 8,732,058	8,815,783	8,896,821	8,975,151	9,050,746	
7,632 9,011,700	51 8,733,475	8,817,155	8,898,149	8,976,433	9,051,983	
8,936 9,012,700	52 8,734,891	8,818,527	8,899,476	8,977,715	9,053,219	
10,240 9,013,700	53 8,736,307	8,819,898	8,900,802	8,978,996	9,054,454	
11,543 9,014,700	54 8,737,722	8,821,268	8,902,127	8,980,276	9,055,688	
12,845 9,015,700	55 8,739,137	8,822,638	8,903,452	8,981,555	9,056,922	
14,146 9,016,700	56 8,740,551	8,824,007	8,904,776	8,982,833	9,058,155	
15,446 9,017,700	57 8,741,964	8,825,375	8,906,099	8,984,111	9,059,387	
16,746 9,018,700	58 8,743,376	8,826,743	8,907,422	8,985,388	9,060,618	
18,045 9,019,700	59 8,744,787	8,828,110	8,908,744	8,986,664	9,061,848	
19,345 9,020,700	60 8,746,197	8,829,476	8,910,065	8,987,940	9,063,078	

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	65	66	67	68	69
0	9,063,078	9,135,455	9,205,049	9,271,839	9,335,804
1	9,064,307	9,136,638	9,206,185	9,272,928	9,336,846
2	9,065,535	9,137,820	9,207,321	9,274,017	9,337,887
3	9,066,763	9,139,001	9,208,456	9,275,105	9,338,928
4	9,067,990	9,140,181	9,209,590	9,276,192	9,339,968
5	9,069,216	9,141,361	9,210,723	9,277,278	9,341,007
6	9,070,441	9,142,540	9,211,855	9,278,363	9,342,045
7	9,071,665	9,143,718	9,212,986	9,279,448	9,343,082
8	9,072,889	9,144,895	9,214,117	9,280,532	9,344,119
9	9,074,112	9,146,072	9,215,247	9,281,615	9,345,155
10	9,075,334	9,147,248	9,216,376	9,282,697	9,346,190
11	9,076,555	9,148,423	9,217,504	9,283,778	9,347,224
12	9,077,775	9,149,597	9,218,631	9,284,859	9,348,257
13	9,078,995	9,150,770	9,219,758	9,285,939	9,349,289
14	9,080,214	9,151,943	9,220,884	9,287,018	9,350,321
15	9,081,432	9,153,115	9,222,010	9,288,096	9,351,352
16	9,082,649	9,154,286	9,223,135	9,289,173	9,352,382
17	9,083,866	9,155,457	9,224,259	9,290,250	9,353,411
18	9,085,082	9,156,627	9,225,382	9,291,326	9,354,440
19	9,086,297	9,157,796	9,226,504	9,292,401	9,355,468
20	9,087,512	9,158,964	9,227,625	9,293,476	9,356,495
21	9,088,726	9,160,131	9,228,746	9,294,550	9,357,521
22	9,089,939	9,161,297	9,229,866	9,295,623	9,358,546
23	9,091,151	9,162,463	9,230,985	9,296,695	9,359,571
24	9,092,362	9,163,628	9,232,103	9,297,766	9,360,595
25	9,093,572	9,164,792	9,233,220	9,298,836	9,361,618
26	9,094,781	9,165,955	9,234,337	9,299,905	9,362,640
27	9,095,990	9,167,117	9,235,453	9,300,974	9,363,662
28	9,097,198	9,168,279	9,236,568	9,302,042	9,364,683
29	9,098,406	9,169,440	9,237,682	9,303,109	9,365,703
30	9,099,613	9,170,601	9,238,795	9,304,176	9,366,722

	65	66	67	68	69
30	9,099,613	9,170,601	9,238,795	9,304,176	9,366,722
31	9,100,819	9,171,761	9,239,908	9,305,242	9,367,740
32	9,102,024	9,172,920	9,241,020	9,306,307	9,368,758
33	9,103,228	9,174,078	9,242,131	9,307,371	9,369,775
34	9,134,432	9,175,235	9,243,242	9,308,434	9,370,791
35	9,105,635	9,176,391	9,244,352	9,309,497	9,371,806
36	9,106,837	9,177,547	9,245,461	9,310,559	9,372,820
37	9,108,038	9,178,702	9,246,569	9,311,620	9,373,834
38	9,109,238	9,179,856	9,247,676	9,312,680	9,374,847
39	9,110,438	9,181,009	9,248,782	9,313,739	9,375,859
40	9,111,637	9,182,161	9,249,888	9,314,798	9,376,870
41	9,112,835	9,183,313	9,250,993	9,315,856	9,377,880
42	9,114,032	9,184,464	9,252,097	9,316,913	9,378,889
43	9,115,229	9,185,614	9,253,200	9,317,969	9,379,898
44	9,116,425	9,186,763	9,254,303	9,319,024	9,380,906
45	9,117,620	9,187,912	9,255,405	9,320,079	9,381,913
46	9,118,814	9,189,060	9,256,506	9,321,133	9,382,919
47	9,120,007	9,190,207	9,257,606	9,322,186	9,383,925
48	9,121,200	9,191,353	9,258,706	9,323,238	9,384,930
49	9,122,392	9,192,499	9,259,805	9,324,290	9,385,934
50	9,123,584	9,193,644	9,260,903	9,325,341	9,386,937
51	9,124,775	9,194,788	9,262,000	9,326,391	9,387,939
52	9,125,965	9,195,931	9,263,096	9,327,440	9,388,941
53	9,127,154	9,197,073	9,264,192	9,328,488	9,389,942
54	9,128,342	9,198,215	9,265,287	9,329,535	9,390,942
55	9,129,529	9,199,356	9,266,381	9,330,582	9,391,941
56	9,130,716	9,200,496	9,267,474	9,331,628	9,392,940
57	9,131,902	9,201,635	9,268,566	9,332,673	9,393,938
58	9,133,087	9,202,774	9,269,658	9,333,717	9,394,935
59	9,134,271	9,203,912	9,270,749	9,334,761	9,395,931
60	9,135,455	9,205,049	9,271,839	9,335,804	9,396,926

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	70	71	72	73	74
0	9,396,926	9,455,186	9,510,565	9,563,048	9,612,617
1	9,397,921	9,456,133	9,511,464	9,563,898	9,613,418
2	9,398,915	9,457,079	9,512,362	9,564,747	9,614,219
3	9,399,908	9,458,024	9,513,259	9,565,596	9,615,019
4	9,400,900	9,458,968	9,514,155	9,566,444	9,615,818
5	9,401,891	9,459,911	9,515,050	9,567,291	9,616,616
6	9,402,882	9,460,854	9,515,944	9,568,137	9,617,413
7	9,403,872	9,461,796	9,516,838	9,568,982	9,618,209
8	9,404,861	9,462,737	9,517,731	9,569,826	9,619,005
9	9,405,849	9,463,677	9,518,623	9,570,670	9,619,800
10	9,406,836	9,464,616	9,519,514	9,571,513	9,620,594
11	9,407,822	9,465,555	9,520,404	9,572,355	9,621,387
12	9,408,808	9,466,493	9,521,294	9,573,196	9,622,179
13	9,409,793	9,467,430	9,522,183	9,574,036	9,622,971
14	9,410,777	9,468,366	9,523,071	9,574,875	9,623,762
15	9,411,760	9,469,301	9,523,958	9,575,714	9,624,552
16	9,412,742	9,470,235	9,524,844	9,576,552	9,625,341
17	9,413,724	9,471,170	9,525,730	9,577,389	9,626,129
18	9,414,705	9,472,103	9,526,615	9,578,225	9,626,917
19	9,415,685	9,473,035	9,527,499	9,579,061	9,627,704
20	9,416,665	9,473,967	9,528,382	9,579,896	9,628,490
21	9,417,644	9,474,898	9,529,264	9,580,730	9,629,275
22	9,418,622	9,475,828	9,530,146	9,581,563	9,630,059
23	9,419,599	9,476,757	9,531,027	9,582,395	9,630,843
24	9,420,575	9,477,685	9,531,907	9,583,226	9,631,626
25	9,421,550	9,478,612	9,532,786	9,584,057	9,632,408
26	9,422,525	9,479,539	9,533,664	9,584,887	9,633,189
27	9,423,499	9,480,465	9,534,541	9,585,716	9,633,969
28	9,424,472	9,481,390	9,535,418	9,586,544	9,634,748
29	9,425,444	9,482,314	9,536,294	9,587,371	9,635,527
30	9,426,415	9,483,237	9,537,169	9,588,197	9,636,305

	70	71	72	73	74
30	9,426,415	9,483,237	9,537,169	9,588,197	9,636,305
31	9,427,386	9,484,160	9,538,043	9,589,023	9,637,082
32	9,428,356	9,485,082	9,538,917	9,589,848	9,637,858
33	9,429,325	9,486,003	9,539,790	9,590,672	9,638,633
34	9,430,293	9,486,923	9,540,662	9,591,495	9,639,408
35	9,431,260	9,487,842	9,541,533	9,592,318	9,640,182
36	9,432,227	9,488,761	9,542,403	9,593,140	9,640,955
37	9,433,193	9,489,679	9,543,272	9,593,961	9,641,727
38	9,434,158	9,490,596	9,544,141	9,594,781	9,642,498
39	9,435,122	9,491,512	9,545,009	9,595,600	9,643,268
40	9,436,085	9,492,427	9,545,876	9,596,419	9,644,038
41	9,437,048	9,493,341	9,546,742	9,597,237	9,644,807
42	9,438,010	9,494,255	9,547,607	9,598,054	9,645,575
43	9,438,971	9,495,168	9,548,472	9,598,870	9,646,342
44	9,439,931	9,496,080	9,549,336	9,599,685	9,647,108
45	9,440,890	9,496,991	9,550,199	9,600,499	9,647,873
46	9,441,849	9,497,902	9,551,061	9,601,313	9,648,638
47	9,442,807	9,498,812	9,551,922	9,602,126	9,649,402
48	9,443,764	9,499,721	9,552,783	9,602,938	9,650,165
49	9,444,720	9,500,629	9,553,643	9,603,749	9,650,927
50	9,445,676	9,501,536	9,554,502	9,604,559	9,651,689
51	9,446,631	9,502,443	9,555,360	9,605,368	9,652,450
52	9,447,585	9,503,349	9,556,217	9,606,177	9,653,210
53	9,448,538	9,504,254	9,557,074	9,606,985	9,653,969
54	9,449,490	9,505,158	9,557,930	9,607,792	9,654,727
55	9,450,441	9,506,061	9,558,785	9,608,598	9,655,484
56	9,451,392	9,506,963	9,559,639	9,609,403	9,656,240
57	9,452,342	9,507,865	9,560,492	9,610,208	9,656,996
58	9,453,291	9,508,766	9,561,345	9,611,012	9,657,751
59	9,454,239	9,509,666	9,562,197	9,611,815	9,658,505
60	9,455,186	9,510,565	9,563,048	9,612,617	9,659,258

	75	76	77	78	79
0	9,659,258	9,702,957	9,743,700	9,781,476	9,816,272
1	9,660,011	9,703,660	9,744,355	9,782,080	9,816,827
2	9,660,763	9,704,363	9,745,008	9,782,684	9,817,381
3	9,661,514	9,705,065	9,745,660	9,783,287	9,817,934
4	9,662,264	9,705,766	9,746,312	9,783,889	9,818,486
5	9,663,013	9,706,466	9,746,963	9,784,490	9,819,037
6	9,663,761	9,707,165	9,747,613	9,785,090	9,819,587
7	9,664,508	9,707,863	9,748,262	9,785,689	9,820,137
8	9,665,255	9,708,561	9,748,910	9,786,288	9,820,686
9	9,666,001	9,709,258	9,749,557	9,786,886	9,821,234
10	9,666,746	9,709,954	9,750,203	9,787,483	9,821,781
11	9,667,490	9,710,649	9,750,849	9,788,079	9,822,327
12	9,668,233	9,711,343	9,751,494	9,788,674	9,822,872
13	9,668,976	9,712,036	9,752,138	9,789,268	9,823,417
14	9,669,718	9,712,729	9,752,781	9,789,862	9,823,961
15	9,670,459	9,713,421	9,753,423	9,790,455	9,824,504
16	9,671,199	9,714,112	9,754,065	9,791,047	9,825,046
17	9,671,938	9,714,802	9,754,706	9,791,638	9,825,587
18	9,672,677	9,715,491	9,755,346	9,792,228	9,826,128
19	9,673,415	9,716,180	9,755,985	9,792,818	9,826,668
20	9,674,152	9,716,868	9,756,623	9,793,407	9,827,207
21	9,674,888	9,717,555	9,757,260	9,793,995	9,827,745
22	9,675,623	9,718,241	9,757,897	9,794,582	9,828,282
23	9,676,357	9,718,926	9,758,533	9,795,168	9,828,818
24	9,677,091	9,719,610	9,759,168	9,795,753	9,829,354
25	9,677,824	9,720,294	9,759,802	9,796,337	9,829,889
26	9,678,556	9,720,977	9,760,435	9,796,921	9,830,423
27	9,679,287	9,721,659	9,761,067	9,797,504	9,830,956
28	9,680,017	9,722,340	9,761,699	9,798,086	9,831,488
29	9,680,747	9,723,020	9,762,330	9,798,667	9,832,019
30	9,681,476	9,723,699	9,762,960	9,799,247	9,832,549

79	75	76	77	78	79
30	9,681,476	9,723,699	9,762,960	9,799,247	9,832,549
31	9,682,204	9,724,378	9,763,589	9,799,827	9,833,079
32	9,682,931	9,725,056	9,764,217	9,800,406	9,833,608
33	9,683,657	9,725,733	9,764,845	9,800,984	9,834,136
34	9,684,383	9,726,409	9,765,472	9,801,561	9,834,663
35	9,685,108	9,727,085	9,766,098	9,802,137	9,835,189
36	9,685,832	9,727,760	9,766,723	9,802,712	9,835,714
37	9,686,555	9,728,434	9,767,347	9,803,287	9,836,239
38	9,687,277	9,729,107	9,767,970	9,803,861	9,836,763
39	9,687,998	9,729,779	9,768,593	9,804,434	9,837,286
40	9,688,719	9,730,450	9,769,215	9,805,006	9,837,808
41	9,689,439	9,731,120	9,769,836	9,805,577	9,838,329
42	9,690,158	9,731,789	9,770,456	9,806,147	9,838,850
43	9,690,876	9,732,458	9,771,075	9,806,716	9,839,370
44	9,691,593	9,733,126	9,771,693	9,807,285	9,839,889
45	9,692,309	9,733,793	9,772,311	9,807,853	9,840,407
46	9,693,025	9,734,459	9,772,928	9,808,420	9,840,924
47	9,693,740	9,735,124	9,773,544	9,808,986	9,841,440
48	9,694,454	9,735,789	9,774,159	9,809,551	9,841,956
49	9,695,167	9,736,453	9,774,773	9,810,116	9,842,471
50	9,695,879	9,737,116	9,775,387	9,810,680	9,842,985
51	9,696,590	9,737,778	9,776,000	9,811,243	9,843,498
52	9,697,301	9,738,439	9,776,612	9,811,850	9,844,010
53	9,698,011	9,739,099	9,777,223	9,812,366	9,844,521
54	9,698,720	9,739,759	9,777,833	9,812,926	9,845,032
55	9,699,428	9,740,418	9,778,442	9,813,486	9,845,542
56	9,700,135	9,741,076	9,779,050	9,814,045	9,846,051
57	9,700,842	9,741,733	9,779,658	9,814,603	9,846,559
58	9,701,548	9,742,389	9,780,265	9,815,160	9,847,066
59	9,702,253	9,743,045	9,780,871	9,815,716	9,847,572
60	9,702,957	9,743,700	9,781,476	9,816,272	9,848,078

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	80	81	82	83	84
0	9,848,078	9,876,883	9,902,681	9,925,461	9,945,219
1	9,848,583	9,877,338	9,903,085	9,925,916	9,945,523
2	9,849,087	9,877,792	9,903,489	9,926,169	9,945,826
3	9,849,590	9,878,245	9,903,892	9,926,521	9,946,128
4	9,850,092	9,878,697	9,904,294	9,926,873	9,946,429
5	9,850,593	9,879,148	9,904,695	9,927,224	9,946,729
6	9,851,093	9,879,598	9,905,095	9,927,574	9,947,028
7	9,851,593	9,880,048	9,905,494	9,927,923	9,947,327
8	9,852,092	9,880,497	9,905,893	9,928,271	9,947,625
9	9,852,590	9,880,945	9,906,291	9,928,618	9,947,922
10	9,853,087	9,881,392	9,906,688	9,928,965	9,948,218
11	9,853,583	9,881,838	9,907,084	9,929,311	9,948,513
12	9,854,079	9,882,283	9,907,479	9,929,656	9,948,807
13	9,854,574	9,882,728	9,907,873	9,930,000	9,949,100
14	9,855,068	9,883,172	9,908,266	9,930,343	9,949,393
15	9,855,561	9,883,615	9,908,659	9,930,685	9,949,685
16	9,856,053	9,884,057	9,909,051	9,931,026	9,949,976
17	9,856,544	9,884,498	9,909,442	9,931,367	9,950,266
18	9,857,035	9,884,938	9,909,832	9,931,707	9,950,555
19	9,857,525	9,885,378	9,910,221	9,932,046	9,950,844
20	9,858,014	9,885,817	9,910,610	9,932,384	9,951,132
21	9,858,502	9,886,255	9,910,998	9,932,721	9,951,419
22	9,858,989	9,886,692	9,911,385	9,933,057	9,951,705
23	9,859,475	9,887,128	9,911,771	9,933,393	9,951,990
24	9,859,961	9,887,564	9,912,156	9,933,728	9,952,274
25	9,860,446	9,887,999	9,912,540	9,934,062	9,952,557
26	9,860,930	9,888,433	9,912,923	9,934,395	9,952,840
27	9,861,413	9,888,866	9,913,306	9,934,727	9,953,122
28	9,861,895	9,889,298	9,913,688	9,935,058	9,953,403
29	9,862,376	9,889,729	9,914,069	9,935,389	9,953,683
30	9,862,856	9,890,159	9,914,449	9,935,719	9,953,962

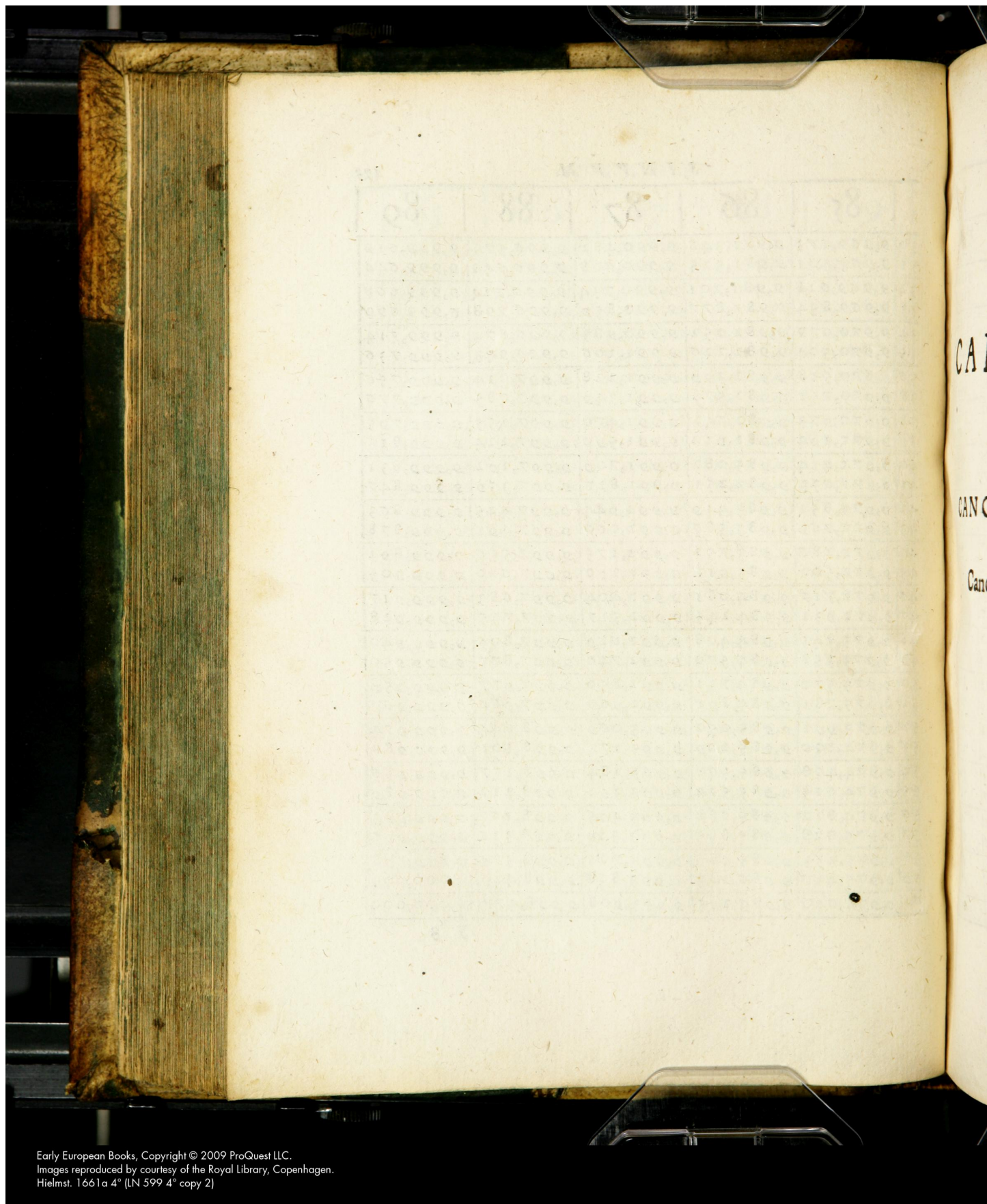
	80	81	82	83	84
30	9,862,856	9,890,159	9,914,449	9,935,719	9,953,962
31	9,863,336	9,890,588	9,914,828	9,936,048	9,954,240
32	9,863,815	9,891,017	9,915,206	9,936,376	9,954,518
33	9,864,293	9,891,445	9,915,584	9,936,703	9,954,795
34	9,864,770	9,891,872	9,915,961	9,937,029	9,955,071
35	9,865,246	9,892,298	9,916,337	9,937,355	9,955,346
36	9,865,722	9,892,723	9,916,712	9,937,680	9,955,620
37	9,866,197	9,893,147	9,917,086	9,938,004	9,955,893
38	9,866,671	9,893,571	9,917,459	9,938,327	9,956,165
39	9,867,144	9,893,994	9,917,832	9,938,649	9,956,437
40	9,867,616	9,894,416	9,918,204	9,938,970	9,956,708
41	9,868,087	9,894,837	9,918,575	9,939,290	9,956,978
42	9,868,557	9,895,257	9,918,945	9,939,609	9,957,247
43	9,869,027	9,895,677	9,919,314	9,939,928	9,957,515
44	9,869,496	9,896,096	9,919,682	9,940,246	9,957,782
45	9,869,964	9,896,514	9,920,049	9,940,563	9,958,049
46	9,870,431	9,896,931	9,920,416	9,940,879	9,958,315
47	9,870,897	9,897,347	9,920,782	9,941,194	9,958,580
48	9,871,362	9,897,762	9,921,147	9,941,509	9,958,844
49	9,871,827	9,898,177	9,921,511	9,941,823	9,959,107
50	9,872,291	9,898,591	9,921,874	9,942,136	9,959,370
51	9,872,754	9,899,004	9,922,236	9,942,448	9,959,632
52	9,873,216	9,899,416	9,922,598	9,942,759	9,959,893
53	9,873,677	9,899,827	9,922,959	9,943,069	9,960,153
54	9,874,137	9,900,237	9,923,319	9,943,379	9,960,412
55	9,874,597	9,900,646	9,923,678	9,943,688	9,960,670
56	9,875,056	9,901,055	9,924,036	9,943,996	9,960,927
57	9,875,514	9,901,463	9,924,393	9,944,303	9,961,183
58	9,875,971	9,901,870	9,924,750	9,944,609	9,961,438
59	9,876,427	9,902,276	9,925,106	9,944,914	9,961,693
60	9,876,883	9,902,681	9,925,461	9,945,219	9,961,947

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	85	86	87	88	89
0	9,961,947	9,975,640	9,986,295	9,993,908	9,998,477
1	9,962,200	9,975,843	9,986,447	9,994,009	9,998,527
2	9,962,452	9,976,045	9,986,598	9,994,109	9,998,577
3	9,962,703	9,976,246	9,986,748	9,994,208	9,998,625
4	9,962,954	9,976,446	9,986,897	9,994,307	9,998,673
5	9,963,204	9,976,645	9,987,045	9,994,405	9,998,720
6	9,963,453	9,976,843	9,987,193	9,994,502	9,998,766
7	9,963,701	9,977,040	9,987,340	9,994,598	9,998,811
8	9,963,948	9,977,237	9,987,486	9,994,693	9,998,856
9	9,964,194	9,977,433	9,987,631	9,994,787	9,998,900
10	9,964,440	9,977,628	9,987,775	9,994,881	9,998,942
11	9,964,685	9,977,822	9,987,918	9,994,974	9,998,984
12	9,964,929	9,978,015	9,988,061	9,995,066	9,999,025
13	9,965,172	9,978,207	9,988,203	9,995,157	9,999,065
14	9,965,414	9,978,398	9,988,344	9,995,247	9,999,105
15	9,965,655	9,978,589	9,988,484	9,995,336	9,999,143
16	9,965,895	9,978,779	9,988,623	9,995,424	9,999,181
17	9,966,135	9,978,968	9,988,761	9,995,512	9,999,218
18	9,966,374	9,979,156	9,988,899	9,995,599	9,999,254
19	9,966,612	9,979,343	9,989,036	9,995,685	9,999,289
20	9,966,849	9,979,530	9,989,172	9,995,770	9,999,323
21	9,967,085	9,979,716	9,989,307	9,995,854	9,999,357
22	9,967,320	9,979,901	9,989,441	9,995,937	9,999,389
23	9,967,555	9,980,085	9,989,574	9,996,019	9,999,421
24	9,967,789	9,980,268	9,989,706	9,996,101	9,999,452
25	9,968,022	9,980,450	9,989,837	9,996,182	9,999,482
26	9,968,254	9,980,631	9,989,968	9,996,262	9,999,511
27	9,968,485	9,980,811	9,990,098	9,996,341	9,999,539
28	9,968,715	9,980,991	9,990,227	9,996,419	9,999,566
29	9,968,944	9,981,170	9,990,355	9,996,496	9,999,593
30	9,969,173	9,981,348	9,990,482	9,996,573	9,999,619

	85	86	87	88	89
30	9,969,173	9,981,348	9,990,482	9,996,573	9,999,619
31	9,969,401	9,981,525	9,990,608	9,996,649	9,999,644
32	9,969,628	9,981,701	9,990,734	9,996,724	9,999,668
33	9,969,854	9,981,877	9,990,859	9,996,798	9,999,692
34	9,970,079	9,982,052	9,990,983	9,996,871	9,999,714
35	9,970,304	9,982,226	9,991,106	9,996,943	9,999,736
36	9,970,528	9,982,399	9,991,228	9,997,014	9,999,756
37	9,970,751	9,982,571	9,991,349	9,997,085	9,999,776
38	9,970,973	9,982,742	9,991,470	9,997,155	9,999,795
39	9,971,194	9,982,912	9,991,590	9,997,224	9,999,813
40	9,971,414	9,983,082	9,991,709	9,997,292	9,999,831
41	9,971,633	9,983,251	9,991,827	9,997,359	9,999,847
42	9,971,851	9,983,419	9,991,944	9,997,425	9,999,863
43	9,972,069	9,983,586	9,992,060	9,997,491	9,999,878
44	9,972,286	9,983,752	9,992,175	9,997,556	9,999,892
45	9,972,502	9,983,917	9,992,290	9,997,620	9,999,905
46	9,972,717	9,984,081	9,992,404	9,997,683	9,999,917
47	9,972,931	9,984,245	9,992,517	9,997,745	9,999,928
48	9,973,145	9,984,408	9,992,629	9,997,806	9,999,940
49	9,973,358	9,984,570	9,992,740	9,997,867	9,999,950
50	9,973,570	9,984,731	9,992,850	9,997,927	9,999,959
51	9,973,781	9,984,891	9,992,960	9,997,986	9,999,967
52	9,973,991	9,985,050	9,993,069	9,998,044	9,999,974
53	9,974,200	9,985,209	9,993,177	9,998,101	9,999,980
54	9,974,408	9,985,367	9,993,284	9,998,157	9,999,986
55	9,974,615	9,985,524	9,993,390	9,998,212	9,999,989
56	9,974,822	9,985,680	9,993,495	9,998,267	9,999,993
57	9,975,028	9,985,835	9,993,599	9,998,321	9,999,996
58	9,975,233	9,985,989	9,993,703	9,998,374	9,999,998
59	9,975,437	9,986,143	9,993,806	9,998,426	10,000,000
60	9,975,640	9,986,295	9,993,908	9,998,477	10,000,000

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	0	1	2	3
0	0,000	174,550	349,207	524,078
1	2,909	177,459	352,120	526,995
2	5,818	180,369	355,033	529,911
3	8,727	183,279	357,945	532,828
4	11,636	186,189	360,858	535,745
5	14,544	189,100	363,770	538,663
6	17,452	192,010	366,683	541,580
7	20,361	194,920	369,596	544,498
8	23,270	197,830	372,508	547,415
9	26,179	200,740	375,421	550,333
10	29,088	203,650	378,334	553,251
11	31,996	206,561	381,247	556,169
12	34,905	209,471	384,160	559,087
13	37,814	212,381	387,073	562,005
14	40,723	215,291	389,987	564,923
15	43,632	218,201	392,900	567,841
16	46,541	221,111	395,814	570,759
17	49,450	224,022	398,727	573,678
18	52,359	226,932	401,641	576,596
19	55,268	229,842	404,554	579,514
20	58,177	232,752	407,468	582,433
21	61,086	235,663	410,382	585,352
22	63,995	238,574	413,295	588,270
23	66,904	241,485	416,209	591,189
24	69,813	244,395	419,123	594,108
25	72,722	247,306	422,037	597,028
26	75,631	250,217	424,951	599,947
27	78,540	253,128	427,866	602,866
28	81,450	256,038	430,780	605,786
29	84,359	258,949	433,694	608,705
30	87,268	261,859	436,609	611,625

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30	87,268	261,859	436,609	611,625
31	90,177	264,770	439,523	614,544
32	93,086	267,681	442,438	617,464
33	95,995	270,592	445,353	620,384
34	98,904	273,503	448,267	623,304
35	101,814	276,414	451,182	626,225
36	104,723	279,325	454,097	629,145
37	107,632	282,237	457,012	632,066
38	110,541	285,148	459,927	634,986
39	113,450	288,059	462,842	637,907
40	116,360	290,970	465,757	640,828
41	119,269	293,882	468,672	643,749
42	122,178	296,794	471,588	646,671
43	125,088	299,705	474,503	649,592
44	127,997	302,617	477,419	652,514
45	130,906	305,528	480,335	655,435
46	133,816	308,439	483,251	658,357
47	136,725	311,351	486,166	661,278
48	139,635	314,262	489,082	664,200
49	142,544	317,174	491,997	667,121
50	145,454	320,085	494,913	670,043
51	148,363	322,997	497,829	672,965
52	151,273	325,909	500,745	675,888
53	154,182	328,821	503,662	678,810
54	157,092	331,733	506,578	681,733
55	160,001	334,645	509,495	684,656
56	162,911	337,558	512,411	687,578
57	165,820	340,470	515,328	690,501
58	168,730	343,382	518,244	693,423
59	171,640	346,295	521,161	696,346
60	174,550	349,207	524,078	699,269

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	4	5	6	7
0	699,269	874,886	1,051,042	1,227,846
1	702,193	877,817	1,053,983	1,230,798
2	705,116	880,748	1,056,924	1,233,751
3	708,039	883,680	1,059,866	1,236,704
4	710,962	886,611	1,062,808	1,239,658
5	713,886	889,543	1,065,750	1,242,612
6	716,809	892,475	1,068,692	1,245,566
7	719,733	895,407	1,071,634	1,248,520
8	722,657	898,339	1,074,576	1,251,474
9	725,580	901,271	1,077,518	1,254,428
10	728,504	904,204	1,080,461	1,257,383
11	731,428	907,137	1,083,404	1,260,338
12	734,353	910,070	1,086,347	1,263,293
13	737,277	913,003	1,089,291	1,266,249
14	740,202	915,936	1,092,234	1,269,205
15	743,127	918,870	1,095,178	1,272,161
16	746,052	921,804	1,098,122	1,275,117
17	748,978	924,738	1,101,066	1,278,073
18	751,903	927,671	1,104,010	1,281,029
19	754,829	930,605	1,106,954	1,283,986
20	757,754	933,539	1,109,899	1,286,943
21	760,680	936,473	1,112,844	1,289,900
22	763,606	939,407	1,115,789	1,292,857
23	766,532	942,342	1,118,734	1,295,815
24	769,459	945,277	1,121,680	1,298,773
25	772,385	948,212	1,124,625	1,301,731
26	775,311	951,147	1,127,571	1,304,689
27	778,238	954,083	1,130,517	1,307,648
28	781,164	957,019	1,133,463	1,310,607
29	784,091	959,954	1,136,409	1,313,566
30	787,017	962,890	1,139,355	1,316,525

TANGENTIV M.

179

	4	5	6	7
30	787,017	962,890	1,139,353	1,316,525
31	789,944	965,826	1,142,302	1,319,485
32	792,871	968,763	1,145,249	1,322,445
33	795,799	971,699	1,148,196	1,325,405
34	798,726	974,636	1,151,144	1,328,365
35	801,653	977,573	1,154,092	1,331,325
36	804,581	980,509	1,157,040	1,334,285
37	807,509	983,446	1,159,988	1,337,246
38	810,437	986,383	1,162,936	1,340,207
39	813,365	989,320	1,165,884	1,343,168
40	816,293	992,257	1,168,832	1,346,129
41	819,221	995,195	1,171,781	1,349,091
42	822,150	998,133	1,174,730	1,352,053
43	825,079	1,001,072	1,177,679	1,355,015
44	828,008	1,004,010	1,180,628	1,357,977
45	830,937	1,006,949	1,183,577	1,360,940
46	833,866	1,009,887	1,186,527	1,363,903
47	836,795	1,012,825	1,189,477	1,366,866
48	839,724	1,015,763	1,192,427	1,369,830
49	842,653	1,018,702	1,195,377	1,372,793
50	845,583	1,021,641	1,198,328	1,375,757
51	848,513	1,024,580	1,201,279	1,378,721
52	851,443	1,027,519	1,204,230	1,381,686
53	854,374	1,030,459	1,207,181	1,384,650
54	857,304	1,033,399	1,210,132	1,387,615
55	860,234	1,036,339	1,213,084	1,390,580
56	863,164	1,039,279	1,216,036	1,393,545
57	866,095	1,042,219	1,218,988	1,396,510
58	869,025	1,045,160	1,221,940	1,399,476
59	871,956	1,048,101	1,224,892	1,402,442
60	874,886	1,051,042	1,227,845	1,405,408

2 2

	8	9	10	11
0	1,465,408	1,583,844	1,763,268	1,943,803
1	1,408,374	1,586,826	1,766,268	1,946,822
2	1,411,341	1,589,808	1,769,268	1,949,841
3	1,414,308	1,592,791	1,772,268	1,952,861
4	1,417,275	1,595,774	1,775,269	1,955,881
5	1,420,242	1,598,757	1,778,270	1,958,901
6	1,423,210	1,601,740	1,781,271	1,961,922
7	1,426,178	1,604,723	1,784,272	1,964,943
8	1,429,146	1,607,707	1,787,274	1,967,964
9	1,432,115	1,610,691	1,790,276	1,970,985
10	1,435,084	1,613,675	1,793,278	1,974,007
11	1,438,053	1,616,660	1,796,281	1,977,029
12	1,441,022	1,619,645	1,799,284	1,980,052
13	1,443,992	1,622,630	1,802,287	1,983,075
14	1,446,961	1,625,615	1,805,291	1,986,098
15	1,449,931	1,628,601	1,808,295	1,989,122
16	1,452,901	1,631,587	1,811,299	1,992,146
17	1,455,871	1,634,573	1,814,303	1,995,171
18	1,458,842	1,637,560	1,817,308	1,998,196
19	1,461,813	1,640,547	1,820,313	2,001,221
20	1,464,784	1,643,534	1,823,318	2,004,247
21	1,467,755	1,646,522	1,826,324	2,007,273
22	1,470,727	1,649,510	1,829,329	2,010,299
23	1,473,699	1,652,499	1,832,335	2,013,326
24	1,476,671	1,655,488	1,835,342	2,016,353
25	1,479,644	1,658,477	1,838,349	2,019,380
26	1,482,617	1,661,466	1,841,357	2,022,408
27	1,485,590	1,664,456	1,844,365	2,025,436
28	1,488,563	1,667,446	1,847,373	2,028,464
29	1,491,536	1,670,436	1,850,382	2,031,493
30	1,494,510	1,673,426	1,853,391	2,034,522

	8	9	10	11
30	1,494,510	1,673,426	1,853,391	2,034,522
31	1,497,484	1,676,417	1,856,400	2,037,552
32	1,500,458	1,679,408	1,859,409	2,040,582
33	1,503,433	1,682,399	1,862,419	2,043,612
34	1,506,408	1,685,390	1,865,429	2,046,643
35	1,509,383	1,688,382	1,868,439	2,049,674
36	1,512,358	1,691,374	1,871,449	2,052,705
37	1,515,334	1,694,366	1,874,460	2,055,737
38	1,518,310	1,697,358	1,877,471	2,058,769
39	1,521,286	1,700,351	1,880,482	2,061,801
40	1,524,262	1,703,344	1,883,494	2,064,834
41	1,527,239	1,706,337	1,886,506	2,067,867
42	1,530,216	1,709,331	1,889,518	2,070,900
43	1,533,193	1,712,325	1,892,531	2,073,934
44	1,536,170	1,715,319	1,895,544	2,076,968
45	1,539,148	1,718,313	1,898,558	2,080,002
46	1,542,126	1,721,308	1,901,572	2,083,037
47	1,545,104	1,724,304	1,904,586	2,086,073
48	1,548,082	1,727,300	1,907,601	2,089,109
49	1,551,061	1,730,296	1,910,616	2,092,145
50	1,554,040	1,733,292	1,913,632	2,095,182
51	1,557,019	1,736,287	1,916,648	2,098,219
52	1,559,999	1,739,284	1,919,664	2,101,256
53	1,562,979	1,742,281	1,922,680	2,104,293
54	1,565,959	1,745,278	1,925,697	2,107,331
55	1,568,940	1,748,275	1,928,714	2,110,369
56	1,571,920	1,751,273	1,931,731	2,113,407
57	1,574,901	1,754,271	1,934,749	2,116,446
58	1,577,882	1,757,270	1,937,767	2,119,485
59	1,580,863	1,760,269	1,940,785	2,122,525
60	1,583,844	1,763,268	1,943,803	2,125,565

	I2	I3	I4	I5
0	2,125,565	2,308,682	2,493,280	2,679,492
1	2,128,605	2,311,746	2,496,370	2,682,610
2	2,131,646	2,314,810	2,499,461	2,685,728
3	2,134,687	2,317,875	2,502,552	2,688,847
4	2,137,729	2,320,940	2,505,643	2,691,966
5	2,140,771	2,324,006	2,508,735	2,695,086
6	2,143,814	2,327,072	2,511,827	2,698,206
7	2,146,857	2,330,139	2,514,920	2,701,327
8	2,149,900	2,333,206	2,518,013	2,704,448
9	2,152,944	2,336,273	2,521,106	2,707,570
10	2,155,988	2,339,341	2,524,200	2,710,693
11	2,159,032	2,342,419	2,527,294	2,713,816
12	2,162,077	2,345,478	2,530,389	2,716,940
13	2,165,122	2,348,547	2,533,484	2,720,064
14	2,168,167	2,351,616	2,536,580	2,723,189
15	2,171,213	2,354,686	2,539,676	2,726,314
16	2,174,259	2,357,757	2,542,773	2,729,439
17	2,177,306	2,360,828	2,545,870	2,732,565
18	2,180,353	2,363,899	2,548,968	2,735,691
19	2,183,400	2,366,971	2,552,066	2,738,818
20	2,186,448	2,370,043	2,555,165	2,741,945
21	2,189,496	2,373,116	2,558,264	2,745,073
22	2,192,544	2,376,189	2,561,364	2,748,201
23	2,195,593	2,379,263	2,564,464	2,751,330
24	2,198,642	2,382,337	2,567,564	2,754,459
25	2,201,692	2,385,411	2,570,665	2,757,589
26	2,204,742	2,388,486	2,573,766	2,760,729
27	2,207,792	2,391,561	2,576,868	2,763,856
28	2,210,843	2,394,636	2,579,970	2,766,981
29	2,213,894	2,397,712	2,583,073	2,770,113
30	2,216,946	2,400,788	2,586,176	2,773,245

15	12	13	14	15
2,679,491	30 2,216,946	2,400,788	2,586,176	2,773,245
2,682,511	31 2,219,998	2,403,865	2,589,280	2,776,378
2,685,571	32 2,223,051	2,406,942	2,592,384	2,779,511
2,688,642	33 2,226,104	2,410,020	2,595,489	2,782,645
2,691,713	34 2,229,157	2,413,098	2,598,594	2,785,779
2,694,784	35 2,232,211	2,416,176	2,601,700	2,788,914
2,697,855	36 2,235,265	2,419,255	2,604,806	2,792,050
2,700,926	37 2,238,319	2,422,334	2,607,912	2,795,186
2,703,997	38 2,241,374	2,425,414	2,611,019	2,798,323
2,707,068	39 2,244,429	2,428,494	2,614,126	2,801,460
2,710,139	40 2,247,485	2,431,574	2,617,234	2,804,597
2,713,210	41 2,250,541	2,434,655	2,620,342	2,807,735
2,716,281	42 2,253,597	2,437,736	2,623,451	2,810,873
2,719,352	43 2,256,654	2,440,818	2,626,560	2,814,012
2,722,423	44 2,259,711	2,443,900	2,629,670	2,817,151
2,725,494	45 2,262,769	2,446,983	2,632,780	2,820,291
2,728,565	46 2,265,827	2,450,066	2,635,891	2,823,432
2,731,636	47 2,268,885	2,453,150	2,639,002	2,826,573
2,734,707	48 2,271,944	2,456,234	2,642,114	2,829,714
2,737,778	49 2,275,003	2,459,319	2,645,226	2,832,856
2,740,849	50 2,278,063	2,462,404	2,648,339	2,835,999
2,743,920	51 2,281,123	2,465,490	2,651,452	2,839,142
2,746,991	52 2,284,183	2,468,576	2,654,566	2,842,286
2,750,062	53 2,287,244	2,471,662	2,657,680	2,845,430
2,753,133	54 2,290,305	2,474,749	2,660,795	2,848,575
2,756,204	55 2,293,367	2,477,836	2,663,910	2,851,720
2,759,275	56 2,296,429	2,480,924	2,667,026	2,854,866
2,762,346	57 2,299,492	2,484,012	2,670,142	2,858,012
2,765,417	58 2,302,555	2,487,101	2,673,258	2,861,159
2,768,488	59 2,305,618	2,490,191	2,676,375	2,864,306
2,771,559	60 2,308,682	2,493,280	2,679,492	2,867,453

	16	17	18	19
0	2,897,453	3,057,307	3,249,197	3,443,276
1	2,870,601	3,060,487	3,252,413	3,446,530
2	2,873,749	3,063,669	3,255,630	3,449,785
3	2,876,898	3,066,851	3,258,848	3,453,040
4	2,880,048	3,070,034	3,262,066	3,456,296
5	2,883,198	3,073,218	3,265,285	3,459,553
6	2,886,349	3,076,402	3,268,504	3,462,810
7	2,889,501	3,079,587	3,271,724	3,466,068
8	2,892,653	3,082,772	3,274,944	3,469,326
9	2,895,806	3,085,958	3,278,165	3,472,585
10	2,898,960	3,089,144	3,281,387	3,475,845
11	2,902,114	3,092,331	3,284,609	3,479,105
12	2,905,268	3,095,518	3,287,832	3,482,366
13	2,908,423	3,098,706	3,291,055	3,485,628
14	2,911,578	3,101,895	3,294,280	3,488,891
15	2,914,734	3,105,084	3,297,505	3,492,154
16	2,917,890	3,108,274	3,300,731	3,495,418
17	2,921,047	3,111,464	3,303,957	3,498,683
18	2,924,204	3,114,655	3,307,184	3,501,949
19	2,927,362	3,117,846	3,310,411	3,505,215
20	2,930,520	3,121,038	3,313,639	3,508,482
21	2,933,679	3,124,230	3,316,868	3,511,749
22	2,936,839	3,127,423	3,320,097	3,515,017
23	2,939,999	3,130,617	3,323,327	3,518,286
24	2,943,160	3,133,811	3,326,558	3,521,555
25	2,946,321	3,137,006	3,329,789	3,524,825
26	2,949,483	3,140,201	3,333,020	3,528,096
27	2,952,645	3,143,397	3,336,252	3,531,368
28	2,955,808	3,146,594	3,339,485	3,534,640
29	2,958,971	3,149,791	3,342,719	3,537,913
30	2,962,135	3,152,989	3,345,953	3,541,186

TANGENTIVM.

185

	16	17	18	19
30	2,962,135	3,152,989	3,345,953	3,541,186
31	2,965,299	3,156,187	3,349,188	3,544,460
32	2,968,464	3,159,386	3,352,423	3,547,735
33	2,971,629	3,162,585	3,355,659	3,551,010
34	2,974,795	3,165,785	3,358,896	3,554,286
35	2,977,962	3,168,986	3,362,133	3,557,563
36	2,981,129	3,172,187	3,365,371	3,560,840
37	2,984,297	3,175,389	3,368,610	3,564,118
38	2,987,465	3,178,591	3,371,850	3,567,397
39	2,990,634	3,181,794	3,375,090	3,570,676
40	2,993,804	3,184,998	3,378,331	3,573,956
41	2,996,973	3,188,202	3,381,572	3,577,237
42	3,000,143	3,191,407	3,384,814	3,580,519
43	3,003,314	3,194,613	3,388,057	3,583,801
44	3,006,486	3,197,819	3,391,300	3,587,084
45	3,009,658	3,201,026	3,394,544	3,590,367
46	3,012,831	3,204,233	3,397,798	3,593,651
47	3,016,004	3,207,441	3,401,033	3,596,936
48	3,019,178	3,210,649	3,404,279	3,600,221
49	3,022,353	3,213,858	3,407,525	3,603,507
50	3,025,528	3,217,067	3,410,772	3,606,794
51	3,028,703	3,220,277	3,414,020	3,610,082
52	3,031,879	3,223,488	3,417,268	3,613,370
53	3,035,055	3,226,699	3,420,517	3,616,659
54	3,038,232	3,229,911	3,423,766	3,619,949
55	3,041,410	3,233,124	3,427,016	3,623,239
56	3,044,588	3,236,337	3,430,267	3,626,530
57	3,047,767	3,239,551	3,433,518	3,629,822
58	3,050,946	3,242,766	3,436,770	3,633,115
59	3,054,126	3,245,981	3,440,023	3,636,408
60	3,057,307	3,249,197	3,443,276	3,639,702

A

	O2	21	22	32
0	3,639,702	3,838,640	4,040,262	4,244,748
1	3,642,997	3,841,978	4,043,647	4,248,182
2	3,646,293	3,845,316	4,047,031	4,251,617
3	3,649,589	3,848,655	4,050,416	4,255,052
4	3,652,886	3,851,995	4,053,802	4,258,488
5	3,656,183	3,855,336	4,057,189	4,261,925
6	3,659,481	3,858,678	4,060,577	4,265,363
7	3,662,780	3,862,020	4,063,966	4,268,801
8	3,666,079	3,865,363	4,067,356	4,272,240
9	3,669,379	3,868,707	4,070,747	4,275,680
10	3,672,680	3,872,052	4,074,139	4,279,121
11	3,675,982	3,875,397	4,077,531	4,282,563
12	3,679,284	3,878,743	4,080,924	4,286,006
13	3,682,587	3,882,090	4,084,318	4,289,450
14	3,685,891	3,885,438	4,087,713	4,292,895
15	3,689,195	3,888,787	4,091,109	4,296,340
16	3,692,500	3,892,136	4,094,506	4,299,786
17	3,695,806	3,895,486	4,097,903	4,303,233
18	3,699,113	3,898,837	4,101,301	4,306,681
19	3,702,420	3,902,188	4,104,699	4,310,130
20	3,705,728	3,905,540	4,108,097	4,313,580
21	3,709,037	3,908,893	4,111,497	4,317,031
22	3,712,347	3,912,247	4,114,898	4,320,482
23	3,715,657	3,915,601	4,118,300	4,323,934
24	3,718,968	3,918,956	4,121,704	4,327,387
25	3,722,279	3,922,312	4,125,107	4,330,841
26	3,725,591	3,925,669	4,128,511	4,334,296
27	3,728,904	3,929,027	4,131,916	4,337,752
28	3,732,218	3,932,385	4,135,322	4,341,209
29	3,735,533	3,935,744	4,138,728	4,344,666
30	3,738,848	3,939,104	4,142,135	4,348,124

	20	21	22	23
30	3,738,848	3,939,104	4,142,135	4,348,124
31	3,742,164	3,942,465	4,145,544	4,351,583
32	3,745,480	3,945,826	4,148,953	4,355,043
33	3,748,797	3,949,188	4,152,363	4,358,504
24	3,752,115	3,952,551	4,155,773	4,361,966
35	3,755,434	3,955,915	4,159,184	4,365,429
36	3,758,753	3,959,280	4,162,596	4,368,893
37	3,762,073	3,962,646	4,166,009	4,372,357
38	3,765,394	3,966,012	4,169,423	4,375,822
39	3,768,716	3,969,379	4,172,838	4,379,288
40	3,772,038	3,972,746	4,176,255	4,382,755
41	3,775,361	3,976,114	4,179,672	4,386,223
42	3,778,685	3,979,483	4,183,090	4,389,692
43	3,782,010	3,982,853	4,186,509	4,393,162
44	3,785,335	3,986,224	4,189,928	4,396,633
45	3,788,661	3,989,596	4,193,348	4,400,105
46	3,791,988	3,992,969	4,196,769	4,403,578
47	3,795,315	3,996,342	4,200,191	4,407,051
48	3,798,643	3,999,716	4,203,613	4,410,525
49	3,801,972	4,003,090	4,207,036	4,414,000
50	3,805,302	4,006,465	4,210,460	4,417,476
51	3,808,632	4,009,841	4,213,885	4,420,953
52	3,811,963	4,013,217	4,217,311	4,424,431
53	3,815,295	4,016,594	4,220,738	4,427,910
54	3,818,628	4,019,972	4,224,165	4,431,390
55	3,821,961	4,023,351	4,227,593	4,434,871
56	3,825,295	4,026,731	4,231,022	4,438,352
57	3,828,630	4,030,112	4,234,452	4,441,834
58	3,831,966	4,033,494	4,237,883	4,445,317
59	3,835,303	4,036,877	4,241,315	4,448,801
60	3,838,640	4,040,262	4,244,748	4,452,286

A 2

	24	25	26	27
0	4,452,286	4,663,081	4,877,328	5,095,254
1	4,455,772	4,666,623	4,880,930	5,098,919
2	4,459,259	4,670,166	4,884,533	5,102,585
3	4,462,747	4,673,710	4,888,137	5,106,252
4	4,466,236	4,677,255	4,891,742	5,109,920
5	4,469,726	4,680,801	4,895,347	5,113,589
6	4,473,216	4,684,348	4,898,953	5,117,259
7	4,476,707	4,687,896	4,902,560	5,120,930
8	4,480,199	4,691,444	4,906,168	5,124,602
9	4,483,692	4,694,993	4,909,777	5,128,275
10	4,487,186	4,698,543	4,913,387	5,131,949
11	4,490,681	4,702,094	4,916,998	5,135,625
12	4,494,177	4,705,646	4,920,610	5,139,302
13	4,497,674	4,709,199	4,924,223	5,142,980
14	4,501,172	4,712,753	4,927,838	5,146,659
15	4,504,671	4,716,308	4,931,454	5,150,339
16	4,508,171	4,719,864	4,935,071	5,154,020
17	4,511,672	4,723,422	4,938,689	5,157,702
18	4,515,173	4,726,981	4,942,308	5,161,385
19	4,518,675	4,730,541	4,945,928	5,165,069
20	4,522,178	4,734,102	4,949,549	5,168,755
21	4,525,682	4,737,664	4,953,171	5,172,442
22	4,529,187	4,741,227	4,956,794	5,176,130
23	4,532,693	4,744,790	4,960,418	5,179,819
24	4,536,200	4,748,354	4,964,043	5,183,509
25	4,539,708	4,751,919	4,967,669	5,187,200
26	4,543,217	4,755,485	4,971,296	5,190,892
27	4,546,727	4,759,052	4,974,924	5,194,585
28	4,550,238	4,762,620	4,978,553	5,198,279
29	4,553,750	4,766,189	4,982,184	5,201,974
30	4,557,264	4,769,759	4,985,816	5,205,670

27	24	25	26	27
30	4,557,264	4,769,759	4,985,816	5,205,670
31	4,560,778	4,773,330	4,989,448	5,209,368
32	4,564,293	4,776,902	4,993,081	5,213,067
33	4,567,809	4,780,475	4,996,716	5,216,767
34	4,571,326	4,784,049	5,000,352	5,220,868
35	4,574,843	4,787,624	5,003,989	5,224,170
36	4,578,361	4,791,200	5,007,627	5,227,873
37	4,581,880	4,794,777	5,011,266	5,231,577
38	4,585,400	4,798,355	5,014,906	5,235,283
39	4,588,921	4,801,934	5,018,547	5,238,990
40	4,592,443	4,805,515	5,022,189	5,242,698
41	4,595,966	4,809,096	5,025,832	5,246,407
42	4,599,490	4,812,678	5,029,476	5,250,117
43	4,603,015	4,816,261	5,033,121	5,253,828
44	4,606,541	4,819,845	5,036,767	5,257,540
45	4,610,068	4,823,430	5,040,414	5,261,254
46	4,613,596	4,827,016	5,044,062	5,264,969
47	4,617,125	4,830,603	5,047,712	5,268,685
48	4,620,654	4,834,191	5,051,363	5,272,402
49	4,624,184	4,837,780	5,055,015	5,276,120
50	4,627,715	4,841,371	5,058,668	5,279,839
51	4,631,247	4,844,962	5,062,322	5,283,959
52	4,634,780	4,848,554	5,065,977	5,287,280
53	4,638,314	4,852,147	5,069,633	5,291,003
54	4,641,849	4,855,741	5,073,290	5,294,727
55	4,645,385	4,859,336	5,076,948	5,298,452
56	4,648,922	4,862,932	5,080,607	5,302,168
57	4,652,460	4,866,529	5,084,267	5,305,905
58	4,655,999	4,870,127	5,087,928	5,309,633
59	4,659,540	4,873,727	5,091,590	5,313,363
60	4,663,081	4,877,328	5,095,254	5,317,094

A 3

	28	29	30	31
0	5,317,094	5,543,090	5,773,502	6,008,606
1	5,320,826	5,546,893	5,777,381	6,012,566
2	5,324,559	5,550,697	5,781,262	6,016,528
3	5,328,293	5,554,503	5,785,144	6,020,491
4	5,332,028	5,558,310	5,789,027	6,024,455
5	5,335,765	5,562,118	5,792,911	6,028,420
6	5,339,503	5,565,927	5,796,797	6,032,387
7	5,343,242	5,569,738	5,800,684	6,036,355
8	5,346,982	5,573,550	5,804,572	6,040,324
9	5,350,723	5,577,363	5,808,462	6,044,295
10	5,354,465	5,581,177	5,812,353	6,048,267
11	5,358,209	5,584,993	5,816,245	6,052,241
12	5,361,954	5,588,810	5,820,139	6,056,216
13	5,365,700	5,592,628	5,824,034	6,060,193
14	5,369,447	5,596,447	5,827,930	6,064,171
15	5,373,195	5,600,268	5,831,828	6,068,150
16	5,376,944	5,604,090	5,835,727	6,072,131
17	5,380,694	5,607,913	5,839,627	6,076,113
18	5,384,445	5,611,737	5,843,528	6,080,096
19	5,388,198	5,615,562	5,847,431	6,084,081
20	5,391,952	5,619,388	5,851,335	6,088,067
21	5,395,707	5,623,216	5,855,241	6,092,055
22	5,399,463	5,627,045	5,859,148	6,096,044
23	5,403,221	5,630,875	5,863,056	6,100,035
24	5,406,980	5,634,707	5,866,966	6,104,027
25	5,410,740	5,638,540	5,870,877	6,108,020
26	5,414,501	5,642,374	5,874,789	6,112,015
27	5,418,263	5,646,210	5,878,702	6,116,011
28	5,422,026	5,650,047	5,882,617	6,120,009
29	5,425,791	5,653,885	5,886,533	6,124,008
30	5,429,557	5,657,725	5,890,450	6,128,008

	28	29	30	31
30	5,429,557	5,657,725	5,890,450	6,128,008
31	5,433,324	5,661,566	5,894,369	6,132,010
32	5,437,092	5,665,408	5,898,289	6,136,013
33	5,440,861	5,669,251	5,902,211	6,140,018
34	5,444,632	5,673,096	5,906,134	6,144,024
35	5,448,404	5,676,942	5,910,058	6,148,032
36	5,452,177	5,680,789	5,913,984	6,152,041
37	5,455,951	5,684,637	5,917,911	6,156,052
38	5,459,726	5,688,486	5,921,839	6,160,064
39	5,463,503	5,692,337	5,925,769	6,164,077
40	5,467,281	5,696,189	5,929,700	6,168,092
41	5,471,060	5,700,043	5,933,633	6,172,108
42	5,474,840	5,703,898	5,937,567	6,176,126
43	5,478,621	5,707,754	5,941,502	6,180,147
44	5,482,404	5,711,611	5,945,438	6,184,168
45	5,486,188	5,715,469	5,949,376	6,188,190
46	5,489,973	5,719,329	5,953,315	6,192,213
47	5,493,759	5,723,190	5,957,255	6,196,237
48	5,497,546	5,727,052	5,961,197	6,200,263
49	5,501,335	5,730,916	5,965,140	6,204,290
50	5,505,125	5,734,781	5,969,084	6,208,319
51	5,508,916	5,738,647	5,973,030	6,212,350
52	5,512,708	5,742,515	5,976,979	6,216,382
53	5,516,501	5,746,384	5,980,926	6,220,416
54	5,520,296	5,750,254	5,984,876	6,224,451
55	5,524,092	5,754,125	5,988,827	6,228,488
56	5,527,889	5,757,998	5,992,780	6,232,526
57	5,531,687	5,761,872	5,996,734	6,236,566
58	5,535,487	5,765,747	6,000,690	6,240,607
59	5,539,288	5,769,624	6,004,647	6,244,649
60	5,543,090	5,773,502	6,008,606	6,248,693

	32	33	34	35
0	6,248,693	6,494,076	6,745,085	7,002,075
1	6,252,738	6,498,212	6,749,318	7,006,411
2	6,256,785	6,502,350	6,753,553	7,010,749
3	6,260,834	6,506,489	6,757,789	7,015,088
4	6,264,884	6,510,630	6,762,027	7,019,429
5	6,268,935	6,514,773	6,766,267	7,023,772
6	6,272,988	6,518,917	6,770,508	7,028,117
7	6,277,042	6,523,063	6,774,751	7,032,463
8	6,281,098	6,527,200	6,778,996	7,036,811
9	6,285,155	6,531,359	6,783,243	7,041,161
10	6,289,214	6,535,510	6,787,491	7,045,513
11	6,293,274	6,539,662	6,791,741	7,049,867
12	6,297,336	6,543,816	6,795,993	7,054,223
13	6,301,399	6,547,971	6,800,246	7,058,581
14	6,305,464	6,552,128	6,804,501	7,062,940
15	6,309,530	6,556,287	6,808,758	7,067,301
16	6,313,598	6,560,447	6,813,016	7,071,664
17	6,317,667	6,564,609	6,817,276	7,076,029
18	6,321,738	6,568,772	6,821,538	7,070,395
19	6,325,810	6,572,937	6,825,801	7,084,763
20	6,329,883	6,577,103	6,830,066	7,089,133
21	6,333,958	6,581,271	6,834,333	7,093,505
22	6,338,034	6,585,440	6,838,602	7,097,879
23	6,342,112	6,589,611	6,842,872	7,102,254
24	6,346,191	6,593,784	6,847,144	7,106,631
25	6,350,272	6,597,958	6,851,417	7,111,010
26	6,354,355	6,602,134	6,855,692	7,115,391
27	6,358,439	6,606,312	6,859,969	7,119,773
28	6,362,525	6,610,491	6,864,247	7,124,167
29	6,366,613	6,614,672	6,868,527	7,128,543
30	6,370,702	6,618,855	6,872,809	7,132,931

	32	33	34	35
30	6,370,702	6,618,855	6,872,809	7,132,931
31	6,374,792	6,623,039	6,877,093	7,137,321
32	6,378,884	6,627,225	6,881,379	7,141,713
33	6,382,977	6,631,413	6,885,666	7,146,106
34	6,387,072	6,635,603	6,889,955	7,150,501
35	6,391,169	6,639,792	6,894,246	7,154,878
36	6,395,267	6,643,984	6,898,539	7,159,298
37	6,399,366	6,648,178	6,902,833	7,163,698
38	6,403,467	6,652,373	6,907,129	7,168,100
39	6,407,569	6,656,570	6,911,426	7,172,504
40	6,411,673	6,660,768	6,915,725	7,176,910
41	6,415,779	6,664,968	6,920,026	7,181,318
42	6,419,886	6,669,170	6,924,329	7,185,728
43	6,423,995	6,673,373	6,928,634	7,190,140
44	6,428,105	6,677,578	6,932,940	7,194,554
45	6,432,216	6,681,785	6,937,248	7,198,970
46	6,436,329	6,685,994	6,941,558	7,203,387
47	6,440,444	6,690,204	6,945,869	7,207,806
48	6,444,560	6,694,416	6,950,182	7,212,227
49	6,448,678	6,698,630	6,954,497	7,216,650
50	6,452,798	6,702,845	6,958,813	7,221,075
51	6,456,919	6,707,062	6,963,131	7,225,502
52	6,461,042	6,711,281	6,967,451	7,229,931
53	6,465,166	6,715,501	6,971,773	7,234,362
54	6,469,292	6,719,723	6,976,097	7,238,794
55	6,473,419	6,723,946	6,980,423	7,243,228
56	6,477,548	6,728,171	6,984,750	7,247,664
57	6,481,678	6,732,397	6,989,079	7,252,102
58	6,485,809	6,736,625	6,993,409	7,256,541
59	6,489,942	6,740,854	6,997,741	7,260,982
60	6,494,076	6,745,084	7,002,075	7,265,424

B

	36	37	38	39
0	7,265,424	7,535,541	7,812,856	8,097,840
1	7,269,869	7,540,103	7,817,542	8,102,658
2	7,274,316	7,544,667	7,822,230	8,107,478
3	7,278,765	7,549,233	7,826,920	8,112,300
4	7,283,216	7,553,801	7,831,612	8,117,124
5	7,287,669	7,558,371	7,836,306	8,121,951
6	7,292,124	7,562,943	7,841,002	8,126,780
7	7,296,581	7,567,517	7,845,700	8,131,611
8	7,301,040	7,572,093	7,850,400	8,136,444
9	7,305,501	7,576,670	7,855,102	8,141,280
10	7,309,963	7,581,249	7,859,807	8,146,118
11	7,314,427	7,585,830	7,864,514	8,150,958
12	7,318,893	7,590,413	7,869,223	8,155,801
13	7,323,361	7,594,999	7,873,934	8,160,646
14	7,327,831	7,599,587	7,878,647	8,165,493
15	7,332,303	7,604,177	7,883,363	8,170,343
16	7,336,777	7,608,769	7,888,081	8,175,195
17	7,341,253	7,613,363	7,892,801	8,180,049
18	7,345,731	7,617,959	7,897,523	8,184,905
19	7,350,210	7,622,557	7,902,247	8,189,764
20	7,354,691	7,627,157	7,906,973	8,194,625
21	7,359,174	7,631,759	7,911,702	8,199,488
22	7,363,659	7,636,363	7,916,433	8,204,354
23	7,368,146	7,640,969	7,921,166	8,209,222
24	7,372,635	7,645,577	7,925,901	8,214,092
25	7,377,126	7,650,187	7,930,638	8,218,965
26	7,381,619	7,654,799	7,935,378	8,223,840
27	7,386,114	7,659,413	7,940,120	8,228,717
28	7,390,611	7,664,030	7,944,864	8,233,597
29	7,395,110	7,668,649	7,949,610	8,238,479
30	7,399,610	7,673,270	7,954,358	8,243,363

TANGENTIVM.

195

	36	37	38	39
30	7,399,610	7,673,270	7,954,358	8,243,363
31	7,404,112	7,677,893	7,959,109	8,248,250
32	7,408,616	7,682,518	7,963,862	8,253,139
33	7,413,122	7,687,145	7,968,617	8,258,031
34	7,417,630	7,691,774	7,973,374	8,262,925
35	7,422,140	7,696,405	7,978,133	8,267,821
36	7,426,652	7,701,038	7,982,895	8,272,720
37	7,431,167	7,705,673	7,987,659	8,277,621
38	7,435,684	7,710,310	7,992,425	8,282,524
39	7,440,203	7,714,949	7,997,193	8,287,429
40	7,444,724	7,719,590	8,001,963	8,292,337
41	7,449,246	7,724,233	8,006,736	8,297,247
42	7,453,770	7,728,878	8,011,511	8,302,160
43	7,458,296	7,733,525	8,016,288	8,307,075
44	7,462,824	7,738,175	8,021,067	8,311,992
45	7,467,354	7,742,827	8,025,849	8,316,912
46	7,471,886	7,747,481	8,030,633	8,321,834
47	7,476,420	7,752,137	8,035,419	8,326,759
48	7,480,956	7,756,795	8,040,207	8,331,686
49	7,485,494	7,761,455	8,044,997	8,336,615
50	7,490,033	7,766,117	8,049,790	8,341,547
51	7,494,574	7,770,781	8,054,585	8,346,481
52	7,499,117	7,775,447	8,059,382	8,351,418
53	7,503,663	7,780,116	8,064,181	8,356,357
54	7,508,211	7,784,787	8,068,983	8,361,298
55	7,512,761	7,789,460	8,073,787	8,366,242
56	7,517,313	7,794,135	8,078,593	8,371,188
57	7,521,867	7,798,812	8,083,401	8,376,136
58	7,526,423	7,803,491	8,088,212	8,381,087
59	7,530,981	7,808,172	8,093,025	8,386,040
60	7,535,541	7,812,856	8,097,840	8,390,996

B 2

	40	41	42	43
0	8,390,996	8,692,867	9,004,040	9,325,151
1	8,395,954	8,697,075	9,009,308	9,330,591
2	8,400,915	8,703,085	9,014,579	9,336,034
3	8,405,878	8,708,198	9,019,853	9,341,480
4	8,410,844	8,713,344	9,025,130	9,346,929
5	8,415,812	8,718,433	9,030,410	9,352,381
6	8,420,782	8,723,555	9,035,693	9,357,835
7	8,425,754	8,728,679	9,040,978	9,363,292
8	8,430,729	8,733,806	9,046,266	9,368,752
9	8,435,706	8,738,935	9,051,557	9,374,215
10	8,440,686	8,744,067	9,056,850	9,379,682
11	8,445,668	8,749,201	9,062,146	9,385,152
12	8,450,653	8,754,338	9,067,445	9,390,625
13	8,455,640	8,759,478	9,072,747	9,396,101
14	8,460,630	8,764,620	9,078,052	9,401,580
15	8,465,622	8,769,764	9,083,360	9,407,062
16	8,470,617	8,774,911	9,088,670	9,412,547
17	8,475,614	8,780,061	9,093,983	9,418,034
18	8,480,614	8,785,214	9,099,299	9,423,524
19	8,485,617	8,790,369	9,104,618	9,429,017
20	8,490,622	8,795,527	9,109,940	9,434,513
21	8,495,629	8,800,688	9,115,265	9,440,012
22	8,500,639	8,805,851	9,120,593	9,445,514
23	8,505,651	8,811,017	9,125,923	9,451,019
24	8,510,666	8,816,186	9,131,256	9,456,528
25	8,515,683	8,821,357	9,136,592	9,462,040
26	8,520,703	8,826,531	9,141,930	9,467,555
27	8,525,725	8,831,708	9,147,271	9,473,073
28	8,530,750	8,836,887	9,152,615	9,478,594
29	8,535,777	8,842,069	9,157,962	9,484,118
30	8,540,806	8,847,253	9,163,312	9,489,645

	40	41	42	43
30	8,540,806	8,847,253	9,163,312	9,489,645
31	8,545,838	8,852,440	9,168,665	9,495,175
32	8,550,872	8,857,630	9,174,021	9,500,708
33	8,555,909	8,862,822	9,179,380	9,506,244
34	8,560,949	8,868,017	9,184,741	9,511,783
35	8,565,991	8,873,215	9,190,105	9,517,325
36	8,571,036	8,878,415	9,195,472	9,522,870
37	8,576,083	8,883,628	9,200,842	9,528,419
38	8,581,133	8,888,824	9,206,215	9,533,971
39	8,586,185	8,894,033	9,211,590	9,539,526
40	8,591,239	8,899,244	9,216,968	9,545,084
41	8,596,296	8,904,458	9,222,349	9,550,645
42	8,601,355	8,909,675	9,227,733	9,556,209
43	8,606,417	8,914,894	9,233,120	9,561,776
44	8,611,482	8,920,116	9,238,510	9,567,346
45	8,616,549	8,925,341	9,243,903	9,572,919
46	8,621,619	8,930,568	9,249,399	9,578,495
47	8,626,692	8,935,798	9,254,698	9,584,074
48	8,631,767	8,941,031	9,260,100	9,589,656
49	8,636,845	8,946,267	9,265,505	9,595,241
50	8,641,926	8,951,506	9,270,913	9,600,830
51	8,647,009	8,956,747	9,276,324	9,606,422
52	8,652,095	8,961,991	9,281,738	9,612,017
53	8,657,183	8,967,238	9,287,155	9,617,615
54	8,662,273	8,972,487	9,292,574	9,623,216
55	8,667,366	8,977,739	9,297,996	9,628,820
56	8,672,461	8,982,994	9,303,421	9,634,427
57	8,677,559	8,988,252	9,308,849	9,640,037
58	8,682,659	8,993,512	9,314,280	9,645,651
59	8,687,762	8,998,775	9,319,714	9,651,268
60	8,692,867	9,004,040	9,325,151	9,656,888

B 3

	44	45	46	47
0	9,656,888	10,000,000	10,355,302	10,723,686
1	9,662,511	10,005,820	10,361,332	10,729,942
2	9,668,137	10,011,643	10,367,365	10,736,202
3	9,673,766	10,017,469	10,373,402	10,742,466
4	9,679,398	10,023,299	10,379,443	10,748,734
5	9,685,034	10,029,132	10,385,487	10,755,006
6	9,690,674	10,034,968	10,391,535	10,761,282
7	9,696,315	10,040,808	10,397,587	10,768,562
8	9,701,960	10,046,651	10,403,643	10,773,845
9	9,707,609	10,052,497	10,409,702	10,780,132
10	9,713,261	10,058,347	10,415,765	10,786,423
11	9,718,916	10,064,201	10,421,832	10,792,718
12	9,724,574	10,070,058	10,427,902	10,799,017
13	9,730,235	10,075,918	10,433,976	10,805,320
14	9,735,900	10,081,782	10,440,054	10,811,627
15	9,741,568	10,087,649	10,446,135	10,817,938
16	9,747,239	10,093,520	10,452,220	10,824,253
17	9,752,913	10,099,394	10,458,309	10,830,572
18	9,758,591	10,105,272	10,464,401	10,836,895
19	9,764,272	10,111,153	10,470,407	10,843,222
20	9,769,956	10,117,038	10,476,517	10,849,554
21	9,775,643	10,122,926	10,482,701	10,855,889
22	9,781,334	10,128,818	10,488,808	10,862,228
23	9,787,028	10,134,713	10,494,919	10,868,571
24	9,792,725	10,140,611	10,501,034	10,874,918
25	9,798,425	10,146,513	10,507,153	10,881,269
26	9,804,128	10,152,418	10,513,275	10,887,624
27	9,809,835	10,158,327	10,519,401	10,893,983
28	9,815,545	10,164,239	10,525,531	10,900,346
29	9,821,258	10,170,154	10,531,664	10,906,713
30	9,826,974	10,176,073	10,537,801	10,913,084

TANGENTIV M.

199

47	44	45	46	47
10,721,50	30 9,826,974	10,176,073	10,537,801	10,913,084
10,729,00	31 9,832,694	10,181,996	10,543,942	10,919,459
10,736,50	32 9,838,417	10,187,922	10,550,087	10,925,838
10,744,00	33 9,844,143	10,193,852	10,556,235	10,932,221
10,751,50	34 9,849,872	10,199,785	10,562,387	10,938,608
10,759,00	35 9,855,605	10,205,722	10,568,543	10,945,000
10,766,50	36 9,861,341	10,211,663	10,574,703	10,951,396
10,774,00	37 9,867,080	10,217,607	10,580,867	10,957,796
10,781,50	38 9,872,822	10,223,555	10,587,034	10,964,200
10,789,00	39 9,878,568	10,229,506	10,593,205	10,970,608
10,796,50	40 9,884,317	10,235,460	10,599,280	10,977,020
10,804,00	41 9,890,070	10,241,418	10,605,559	10,983,436
10,811,50	42 9,895,826	10,247,380	10,611,742	10,989,856
10,819,00	43 9,901,585	10,253,345	10,617,929	10,996,280
10,826,50	44 9,907,347	10,259,314	10,624,119	11,002,708
10,834,00	45 9,913,113	10,265,286	10,630,313	11,009,140
10,841,50	46 9,918,882	10,271,262	10,636,511	11,015,577
10,849,00	47 9,924,654	10,277,242	10,642,713	11,022,028
10,856,50	48 9,930,430	10,283,225	10,648,919	11,028,483
10,864,00	49 9,936,209	10,289,212	10,655,128	11,034,942
10,871,50	50 9,941,991	10,295,202	10,661,341	11,041,405
10,879,00	51 9,947,777	10,301,196	10,667,558	11,047,872
10,886,50	52 9,953,566	10,307,193	10,673,779	11,054,343
10,894,00	53 9,959,359	10,313,194	10,680,004	11,060,748
10,901,50	54 9,965,155	10,319,199	10,686,233	11,067,218
10,909,00	55 9,970,954	10,325,207	10,692,466	11,073,692
10,916,50	56 9,976,756	10,331,219	10,698,702	11,080,170
10,924,00	57 9,982,562	10,337,234	10,704,942	11,086,652
10,931,50	58 9,988,371	10,343,253	10,711,186	11,093,138
10,939,00	59 9,994,184	10,349,276	10,717,434	11,099,629
10,946,50	60 10,000,000	10,355,302	10,723,686	11,106,124

	48	49	50	51
0	11,106,124	11,503,684	11,917,537	12,348,972
1	11,112,623	11,510,444	11,924,580	12,356,320
2	11,119,126	11,517,208	11,931,628	12,363,673
3	11,125,634	11,523,977	11,938,680	12,371,031
4	11,132,146	11,530,751	11,945,737	12,378,394
5	11,138,662	11,537,529	11,952,799	12,385,762
6	11,145,182	11,544,312	11,959,866	12,393,136
7	11,151,706	11,551,100	11,966,938	12,400,515
8	11,158,235	11,557,893	11,974,015	12,407,999
9	11,164,768	11,564,691	11,981,097	12,415,288
10	11,171,305	11,571,494	11,988,183	12,422,683
11	11,177,846	11,578,301	11,995,274	12,430,083
12	11,184,392	11,585,112	12,002,370	12,437,489
13	11,190,942	11,591,928	12,009,471	12,444,900
14	11,197,496	11,598,748	12,016,578	12,452,317
15	11,204,054	11,605,572	12,023,690	12,459,739
16	11,210,617	11,612,401	12,030,807	12,467,167
17	11,217,184	11,619,234	12,037,929	12,474,600
18	11,223,755	11,626,072	12,045,056	12,482,039
19	11,230,330	11,632,915	12,052,188	12,489,484
20	11,236,910	11,639,763	12,059,325	12,496,934
21	11,243,494	11,646,615	12,066,467	12,504,389
22	11,250,082	11,653,472	12,073,614	12,511,850
23	11,256,675	11,660,334	12,080,766	12,519,316
24	11,263,272	11,667,200	12,087,923	12,526,787
25	11,269,873	11,674,071	12,095,085	12,534,264
26	11,276,478	11,680,947	12,102,252	12,541,746
27	11,283,088	11,687,827	12,109,424	12,549,233
28	11,289,702	11,694,712	12,116,601	12,556,725
29	11,296,321	11,701,602	12,123,783	12,564,222
30	11,302,944	11,708,497	12,130,970	12,571,724

	48	49	50	51
30	11,302,944	11,708,497	12,130,970	12,571,724
31	11,309,571	11,715,396	12,138,162	12,579,232
32	11,316,203	11,722,300	12,145,359	12,586,740
33	11,322,899	11,729,208	12,152,561	12,594,265
34	11,329,480	11,736,121	12,159,768	12,601,790
35	11,336,125	11,743,039	12,166,981	12,609,321
36	11,342,774	11,749,962	12,174,199	12,616,858
37	11,349,428	11,756,889	12,181,422	12,624,400
38	11,356,086	11,763,821	12,188,650	12,631,948
39	11,362,748	11,770,758	12,195,883	12,639,501
40	11,369,415	11,777,700	12,203,121	12,647,060
41	11,376,086	11,784,646	12,210,364	12,654,624
42	11,382,762	11,791,597	12,217,613	12,662,294
43	11,389,442	11,798,553	12,224,867	12,669,769
44	11,396,126	11,805,514	12,232,126	12,677,350
45	11,402,815	11,812,479	12,239,390	12,684,937
46	11,409,508	11,819,449	12,246,659	12,692,530
47	11,416,206	11,826,424	12,253,933	12,700,128
48	11,422,908	11,833,404	12,261,212	12,707,732
49	11,429,615	11,840,388	12,268,496	12,715,341
50	11,436,326	11,847,377	12,275,786	12,722,956
51	11,443,042	11,854,371	12,283,081	12,730,577
52	11,449,762	11,861,370	12,290,381	12,738,203
53	11,456,487	11,868,374	12,297,687	12,745,835
54	11,463,216	11,875,383	12,304,998	12,753,473
55	11,469,950	11,882,397	12,312,314	12,761,116
56	11,476,688	11,889,417	12,319,635	12,768,765
57	11,483,431	11,896,438	12,326,961	12,776,420
58	11,490,178	11,903,466	12,334,293	12,784,080
59	11,496,929	11,910,499	12,341,630	12,791,745
60	11,503,684	11,917,537	12,348,972	12,799,416

C

	52	53	54	55
0	12,799,416	13,270,448	13,763,820	14,281,480
1	12,807,093	13,278,483	13,772,243	14,290,325
2	12,814,776	13,286,524	13,780,673	14,299,177
3	12,822,465	13,294,571	13,789,109	14,308,037
4	12,830,159	13,302,624	13,797,552	14,316,905
5	12,837,859	13,310,683	13,806,002	14,325,780
6	12,845,565	13,318,749	13,814,459	14,334,662
7	12,853,277	13,326,821	13,822,922	14,343,552
8	12,860,994	13,334,899	13,831,392	14,352,449
9	12,868,717	13,342,984	13,839,869	14,361,354
10	12,876,445	13,351,075	13,848,352	14,370,266
11	12,884,179	13,359,172	13,856,842	14,379,186
12	12,891,919	13,367,276	13,865,339	14,388,113
13	12,899,665	13,375,386	13,873,843	14,397,048
14	12,907,417	13,383,502	13,882,354	14,405,990
15	12,915,175	13,391,624	13,890,872	14,414,939
16	12,922,939	13,399,753	13,899,397	14,423,896
17	12,930,709	13,407,888	13,907,930	14,432,861
18	12,938,485	13,416,029	13,916,470	14,441,833
19	12,946,267	13,424,177	13,925,017	14,450,812
20	12,954,055	13,432,331	13,933,571	14,459,799
21	12,961,848	13,440,492	13,942,131	14,468,794
22	12,969,647	13,448,659	13,950,698	14,477,797
23	12,977,457	13,456,832	13,959,272	14,486,807
24	12,985,263	13,465,011	13,967,853	14,495,825
25	12,993,080	13,473,197	13,976,441	14,504,850
26	13,000,903	13,481,390	13,985,035	14,513,883
27	13,008,732	13,489,589	13,993,636	14,522,924
28	13,016,567	13,497,794	14,002,244	14,531,972
29	13,024,407	13,506,006	14,010,859	14,541,028
30	13,032,253	13,514,224	14,019,481	14,550,091

	52	53	54	55
30	13,032,253	13,514,224	14,019,481	14,550,091
31	13,040,105	13,522,449	14,028,110	14,559,162
32	13,047,965	13,530,680	14,036,746	14,568,241
33	13,055,827	13,538,918	14,045,389	14,577,327
34	13,063,697	13,547,162	14,054,040	14,586,421
35	13,071,573	13,555,413	14,062,698	14,595,523
36	13,079,455	13,563,670	14,071,363	14,604,633
37	13,087,343	13,571,934	14,080,035	14,613,750
38	13,095,237	13,580,204	14,088,715	14,622,875
39	13,103,138	13,588,481	14,097,402	14,632,007
40	13,111,045	13,596,764	14,106,097	14,641,146
41	13,118,958	13,605,054	14,114,798	14,650,293
42	13,126,877	13,613,350	14,123,506	14,659,449
43	13,134,802	13,621,653	14,132,221	14,668,613
44	13,142,732	13,629,963	14,140,923	14,677,785
45	13,150,668	13,638,279	14,149,672	14,686,965
46	13,158,610	13,646,602	14,158,409	14,696,153
47	13,166,558	13,654,932	14,167,153	14,705,349
48	13,174,512	13,663,268	14,175,904	14,714,553
49	13,182,472	13,671,610	14,184,663	14,723,765
50	13,190,438	13,679,959	14,193,429	14,732,985
51	13,198,411	13,688,315	14,202,202	14,742,212
52	13,206,390	13,696,677	14,210,982	14,751,447
53	13,214,375	13,705,046	14,219,769	14,760,690
54	13,222,367	13,713,422	14,228,563	14,769,941
55	13,230,365	13,721,805	14,237,365	14,779,200
56	13,238,369	13,730,194	14,246,174	14,788,466
57	13,246,379	13,738,590	14,254,990	14,797,740
58	13,254,396	13,746,993	14,263,813	14,807,022
59	13,262,419	13,755,403	14,272,643	14,816,312
60	13,270,448	13,763,820	14,281,480	14,825,610

	56	57	58	59
0	14,825,610	15,398,651	16,003,347	16,642,794
1	14,834,916	15,408,461	16,013,710	16,653,766
2	14,844,230	15,418,280	16,024,083	16,664,742
3	14,853,553	15,428,108	16,034,466	16,675,743
4	14,862,884	15,437,945	16,044,859	16,686,746
5	14,872,223	15,447,791	16,055,261	16,697,760
6	14,881,570	15,457,646	16,065,673	16,708,785
7	14,890,925	15,467,510	16,076,095	16,719,820
8	14,909,288	15,477,382	16,086,527	16,730,866
9	14,909,659	15,487,263	16,096,968	16,741,922
10	14,919,038	15,497,153	16,107,419	16,752,989
11	14,928,426	15,507,052	16,117,880	16,764,067
12	14,937,822	15,516,960	16,128,351	16,775,156
13	14,947,226	15,526,877	16,138,832	16,786,256
14	14,956,638	15,536,803	16,149,322	16,797,367
15	14,966,058	15,546,738	16,159,822	16,808,489
16	14,975,486	15,556,682	16,170,332	16,819,621
17	14,984,923	15,566,636	16,180,852	16,830,764
18	14,994,368	15,576,599	16,191,381	16,841,918
19	15,003,821	15,586,571	16,201,920	16,853,083
20	15,013,283	15,596,552	16,212,469	16,864,259
21	15,022,753	15,606,542	16,223,028	16,875,446
22	15,032,231	15,616,541	16,233,597	16,886,644
23	15,041,717	15,626,549	16,244,176	16,897,853
24	15,051,211	15,636,566	16,254,766	16,909,074
25	15,060,714	15,646,592	16,265,366	16,920,306
26	15,070,225	15,656,627	16,275,976	16,931,549
27	15,079,744	15,666,671	16,286,596	16,942,803
28	15,089,271	15,676,724	16,297,226	16,954,068
29	15,098,807	15,686,786	16,307,866	16,965,344
30	15,108,351	15,696,857	16,318,516	16,976,631

	56	57	58	59
30	15,108,351	15,096,857	16,318,516	16,976,631
31	15,117,903	15,706,938	16,329,176	16,987,929
32	15,127,464	15,717,028	16,339,847	16,999,239
33	15,137,034	15,727,127	16,350,528	17,010,560
34	15,146,612	15,737,235	16,361,219	17,021,892
35	15,156,199	15,747,353	16,371,920	17,033,236
36	15,165,794	15,757,480	16,382,631	17,044,591
37	15,175,398	15,767,616	16,393,352	17,055,957
38	15,185,011	15,777,761	16,404,083	17,067,325
39	15,194,632	15,787,915	16,414,824	17,078,714
40	15,204,261	15,798,078	16,425,575	17,080,115
41	15,213,899	15,808,251	16,436,337	17,101,527
42	15,223,545	15,818,433	16,447,109	17,112,950
43	15,233,200	15,828,625	16,457,892	17,124,384
44	15,242,863	15,838,827	16,468,685	17,135,829
45	15,252,535	15,849,038	16,479,488	17,147,285
46	15,262,216	15,859,259	16,490,302	17,158,752
47	15,271,905	15,869,489	16,501,126	17,170,231
48	15,281,603	15,879,729	16,511,960	17,181,721
49	15,291,309	15,889,979	16,522,805	17,193,222
50	15,301,024	15,900,238	16,533,660	17,204,734
51	15,310,748	15,910,507	16,544,526	17,216,258
52	15,320,481	15,920,785	16,555,402	17,227,794
53	15,330,222	15,931,073	16,566,289	17,239,342
54	15,339,972	15,941,370	16,577,186	17,250,902
55	15,349,730	15,951,676	16,588,094	17,262,473
56	15,359,497	15,961,992	16,599,013	17,274,056
57	15,369,273	15,972,317	16,609,942	17,285,651
58	15,379,057	15,982,651	16,620,882	17,297,258
59	15,388,850	15,992,994	16,631,833	17,308,877
60	15,398,651	16,003,347	16,642,794	17,320,508

C 3

	60	61	62	63
0	17,320,508	18,040,478	18,807,265	19,626,104
1	17,332,150	18,052,860	18,820,471	19,640,225
2	17,343,804	18,065,255	18,833,691	19,654,362
3	17,355,469	18,077,663	18,846,925	19,668,516
4	17,367,146	18,090,084	18,860,174	19,682,686
5	17,378,834	18,102,518	18,873,437	19,696,872
6	17,390,534	18,114,966	18,886,715	19,711,074
7	17,402,246	18,127,427	18,900,007	19,725,293
8	17,413,969	18,139,901	18,913,314	19,739,528
9	17,425,704	18,152,388	18,926,636	19,753,780
10	17,437,451	18,164,889	18,939,972	19,768,048
11	17,449,210	18,177,403	18,953,323	19,782,333
12	17,460,981	18,189,930	18,966,689	19,796,634
13	17,472,764	18,202,470	18,980,070	19,810,951
14	17,484,559	18,215,024	18,993,466	19,825,285
15	17,496,366	18,227,591	19,006,876	19,839,635
16	17,508,185	18,240,171	19,020,301	19,854,002
17	17,520,026	18,252,765	19,033,741	19,868,386
18	17,531,869	18,265,372	19,047,196	19,882,786
19	17,543,724	18,277,992	19,060,665	19,897,203
20	17,555,591	18,290,626	19,074,149	19,911,637
21	17,567,470	18,303,273	19,087,648	19,926,088
22	17,579,362	18,315,934	19,101,162	19,940,555
23	17,591,266	18,328,608	19,114,691	19,955,039
24	17,603,182	18,341,296	19,128,235	19,969,540
25	17,615,111	18,353,997	19,141,795	19,984,057
26	17,627,052	18,366,712	19,155,370	19,998,591
27	17,639,006	18,379,440	19,168,960	20,013,142
28	17,650,972	18,392,182	19,182,565	20,027,709
29	17,662,951	18,404,938	19,196,185	20,042,297
30	17,674,942	18,417,707	19,209,821	20,056,898

	60	61	62	63
30	17,674,242	18,417,707	19,209,821	20,056,898
31	17,686,945	18,430,490	19,223,472	20,071,516
32	17,698,960	18,443,287	19,237,138	20,086,152
33	17,710,987	18,456,098	19,250,819	20,100,805
34	17,723,027	18,468,922	19,264,516	20,115,475
35	17,735,079	18,481,760	19,278,228	20,130,163
36	17,747,143	18,494,612	19,291,955	20,144,868
37	17,759,220	18,507,478	19,305,698	20,159,590
38	17,771,309	18,520,357	19,319,456	20,174,329
39	17,783,410	18,533,250	19,333,230	20,189,086
40	17,795,524	18,546,157	19,347,019	20,203,860
41	17,808,651	18,559,078	19,360,824	20,218,651
42	17,819,790	18,572,013	19,374,644	20,233,460
43	17,831,942	18,584,962	19,388,480	20,248,286
44	17,844,107	18,597,925	19,402,331	20,263,130
45	17,856,285	18,610,902	19,416,198	20,277,991
46	17,868,475	18,623,894	19,430,081	20,292,870
47	17,880,678	18,636,900	19,443,980	20,307,767
48	17,892,894	18,649,920	19,457,894	20,322,681
49	17,905,123	18,662,954	19,471,824	20,337,613
50	17,917,364	18,676,002	19,485,770	20,352,563
51	17,929,618	18,689,064	19,499,732	20,367,531
52	17,941,885	18,702,140	19,513,710	20,382,516
53	17,954,164	18,715,231	19,527,704	20,397,519
54	17,966,456	18,728,335	19,541,714	20,412,539
55	17,978,761	18,741,454	19,555,739	20,427,577
56	17,991,079	18,754,587	19,569,780	20,442,633
57	18,003,410	18,767,735	19,583,837	20,457,706
58	18,015,753	18,780,897	19,597,910	20,472,797
59	18,028,109	18,794,074	19,611,999	20,487,906
60	18,040,478	18,807,265	19,626,104	20,503,034

	64	65	66	67
0	20,503,034	21,445,067	22,460,371	23,558,529
1	20,518,180	21,461,364	22,477,965	23,577,595
2	20,533,344	21,477,681	22,495,582	23,596,687
3	20,548,526	21,494,019	22,513,222	23,615,805
4	20,563,726	21,510,377	22,530,885	23,634,950
5	20,578,945	21,526,756	22,548,571	23,654,121
6	20,594,182	21,543,155	22,566,281	23,673,318
7	20,609,437	21,559,575	22,584,014	23,692,542
8	20,624,711	21,576,015	22,601,771	23,711,793
9	20,640,003	21,592,475	22,619,551	23,731,071
10	20,655,313	21,608,956	22,637,355	23,750,375
11	20,670,642	21,625,458	22,655,183	23,769,706
12	20,685,989	21,641,981	22,673,034	23,789,064
13	20,701,355	21,658,525	22,690,909	23,808,448
14	20,716,739	21,675,090	22,708,808	23,827,859
15	20,732,142	21,691,776	22,726,730	23,847,297
16	20,747,564	21,708,283	22,744,676	23,866,762
17	20,763,004	21,724,911	22,762,646	23,886,254
18	20,778,463	21,741,559	22,780,639	23,905,773
19	20,793,941	21,758,228	22,798,656	23,925,320
20	20,809,438	21,774,918	22,816,696	23,944,895
21	20,824,953	21,791,629	22,834,760	23,964,496
22	20,840,487	21,808,362	22,852,848	23,984,124
23	20,856,040	21,825,116	22,870,960	24,003,779
24	20,871,612	21,841,892	22,889,096	24,023,462
25	20,887,202	21,858,689	22,907,256	24,043,172
26	20,902,811	21,875,508	22,925,441	24,062,910
27	20,918,439	21,892,348	22,943,650	24,082,675
28	20,934,086	21,909,210	22,961,883	24,102,468
29	20,949,752	21,926,094	22,980,141	24,122,289
30	20,965,436	21,943,000	22,998,424	24,142,137

67	64	65	66	67
30	20,965,436	21,943,000	22,928,424	24,142,137
31	20,981,140	21,959,926	23,016,731	24,162,013
32	20,996,863	21,976,874	23,035,062	24,181,917
33	21,012,605	21,993,843	23,053,418	24,201,849
34	21,028,367	22,010,834	23,071,798	24,221,809
35	21,044,148	22,027,846	23,090,203	24,241,798
36	21,059,949	22,044,879	23,108,632	24,261,815
37	21,075,769	22,061,934	23,127,086	24,281,860
38	21,091,609	22,079,011	23,145,565	24,301,934
39	21,107,468	22,096,109	23,164,068	24,322,037
40	21,123,347	22,113,229	23,182,597	24,342,169
41	21,139,246	22,130,372	23,201,151	24,362,329
42	21,155,164	22,147,537	23,219,730	24,382,518
43	21,171,102	22,164,725	23,238,335	24,402,735
44	21,187,059	22,181,935	23,256,965	24,422,981
45	21,203,036	22,199,168	23,275,621	24,443,256
46	21,219,032	22,216,424	23,294,302	24,463,559
47	21,235,048	22,233,703	23,313,008	24,483,891
48	21,251,083	22,251,004	23,331,740	24,504,252
49	21,267,138	22,268,328	23,350,498	24,524,642
50	21,283,213	22,285,675	23,369,282	24,545,061
51	21,299,308	22,303,044	23,388,092	24,565,509
52	21,315,423	22,320,435	23,406,927	24,585,986
53	21,331,558	22,337,848	23,425,788	24,606,492
54	21,347,713	22,355,284	23,444,674	24,627,028
55	21,363,888	22,372,742	23,463,586	24,647,594
56	21,380,083	22,390,223	23,482,523	24,668,189
57	21,396,298	22,407,726	23,501,486	24,688,814
58	21,412,534	22,425,252	23,520,475	24,709,469
59	21,428,790	22,442,800	23,539,489	24,730,154
60	21,445,067	22,460,371	23,558,529	24,750,869

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	68	69	70	71
0	24,750,869	26,050,893	27,474,777	29,042,105
1	24,771,613	26,073,559	27,499,665	29,069,569
2	24,792,387	26,096,260	27,524,592	29,097,080
3	24,813,191	26,118,996	27,549,559	29,124,638
4	24,834,024	26,141,766	27,574,565	29,152,243
5	24,854,887	26,164,571	27,599,612	29,179,895
6	24,875,780	26,187,411	27,624,699	29,207,595
7	24,896,704	26,210,286	27,649,827	29,235,343
8	24,917,659	26,233,196	27,674,995	29,263,139
9	24,938,644	26,256,141	27,700,204	29,290,982
10	24,959,659	26,279,120	27,725,453	29,318,873
11	24,980,705	26,302,135	27,750,742	29,346,811
12	25,001,782	26,325,185	27,776,072	29,374,797
13	25,022,890	26,348,270	27,801,443	29,402,831
14	25,044,029	26,371,390	27,826,855	29,430,913
15	25,065,198	26,394,546	27,852,308	29,459,043
16	25,086,398	26,417,738	27,877,803	29,487,221
17	25,107,629	26,440,966	27,903,339	29,515,446
18	25,128,891	26,464,229	27,928,917	29,543,719
19	25,150,183	26,487,528	27,954,536	29,572,041
20	25,171,506	26,510,863	27,980,196	29,600,411
21	25,192,861	26,534,234	28,005,898	29,628,831
22	25,214,248	26,557,641	28,031,642	29,657,301
23	25,235,666	26,581,084	28,057,429	29,685,820
24	25,257,116	26,604,563	28,083,258	29,714,388
25	25,278,597	26,628,079	28,109,129	29,743,006
26	25,300,110	26,651,631	28,135,043	29,771,674
27	25,321,655	26,675,220	28,160,999	29,800,392
28	25,343,232	26,698,845	28,186,998	29,829,160
29	25,364,841	26,722,507	28,213,040	29,857,978
30	25,386,482	26,746,206	28,239,125	29,886,847

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	68	69	70	71
30	25,386,482	26,746,206	28,239,125	29,886,847
31	25,408,154	26,769,942	28,265,253	29,915,765
32	25,429,858	26,793,716	28,291,424	29,944,734
33	25,451,594	26,817,527	28,317,638	29,973,753
34	25,473,362	26,841,375	28,343,895	30,002,823
35	25,495,162	26,865,260	28,360,195	30,031,943
36	25,516,995	26,889,183	28,396,539	30,061,113
37	25,538,860	26,913,143	28,422,926	30,090,334
38	25,560,758	26,937,141	28,449,357	30,119,605
39	25,582,688	26,961,177	28,475,832	30,148,927
40	25,604,651	26,985,251	28,502,350	30,178,299
41	25,626,647	27,009,362	28,528,913	30,207,723
42	25,648,675	27,033,511	28,555,520	30,237,200
43	25,670,736	27,057,698	28,582,172	30,266,730
44	25,692,830	27,081,922	28,608,868	30,296,312
45	25,714,957	27,106,184	28,635,608	30,325,947
46	25,737,118	27,130,484	28,662,393	30,355,635
47	25,759,312	27,154,823	28,689,222	30,385,375
48	25,781,540	27,179,200	28,716,096	30,415,169
49	25,803,801	27,203,616	28,743,015	30,445,015
50	25,826,096	27,228,070	28,769,979	30,474,915
51	25,848,424	27,252,563	28,796,987	30,504,867
52	25,870,786	27,277,095	28,824,040	30,534,872
53	25,893,181	27,301,667	28,851,139	30,564,930
54	25,915,610	27,326,278	28,878,283	30,595,041
55	25,938,073	27,350,929	28,905,472	30,625,205
56	25,960,569	27,375,620	28,932,707	30,655,423
57	25,983,099	27,400,350	28,959,988	30,685,695
58	26,005,663	27,425,120	28,987,315	30,716,020
59	26,028,261	27,449,929	29,014,687	30,746,400
60	26,050,893	27,474,777	29,042,105	30,776,834

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	72	73	74	75
0	30,776,834	32,708,528	34,874,151	37,320,517
1	30,807,323	32,742,586	34,912,477	37,363,987
2	30,837,866	32,776,709	34,950,881	37,407,551
3	30,868,465	32,810,898	34,989,364	37,451,210
4	30,899,119	32,845,153	35,027,925	37,494,964
5	30,929,828	32,879,477	35,066,565	37,538,814
6	30,960,593	32,913,862	35,105,283	37,582,760
7	30,991,413	32,948,317	35,144,080	37,626,803
8	31,022,289	32,982,839	35,182,956	37,670,943
9	31,053,221	33,017,427	35,221,911	37,715,180
10	31,084,208	33,052,082	35,260,945	37,759,515
11	31,115,252	33,086,802	35,300,059	37,803,948
12	31,146,352	33,121,588	35,339,253	37,848,479
13	31,177,508	33,156,441	35,378,528	37,893,109
14	31,208,720	33,191,362	35,417,883	37,937,838
15	31,239,989	33,226,351	35,457,320	37,982,666
16	31,271,315	33,261,408	35,496,838	38,027,592
17	31,302,698	33,296,534	35,536,438	38,072,616
18	31,334,138	33,331,728	35,576,121	38,117,740
19	31,365,636	33,366,990	35,615,888	38,162,963
20	31,397,191	33,402,321	35,655,739	38,208,285
21	31,428,805	33,437,720	35,695,672	38,253,708
22	31,460,476	33,473,188	35,735,689	38,299,232
23	31,492,205	33,508,725	35,775,789	38,344,857
24	31,523,992	33,544,330	35,815,973	38,390,584
25	31,555,838	33,580,005	35,856,241	38,436,414
26	31,587,742	33,615,750	35,896,593	38,482,347
27	31,619,705	33,651,566	35,937,029	38,528,384
28	31,651,727	33,687,453	35,977,550	38,574,525
29	31,683,807	33,723,410	36,018,156	38,620,772
30	31,715,946	33,759,438	36,058,848	38,667,125

	72	73	74	75
30	31,715,946	33,759,438	36,058,848	38,667,125
31	31,748,144	33,795,535	36,099,623	38,713,580
32	31,780,401	33,831,703	36,140,483	38,760,139
33	31,812,717	33,867,942	36,181,427	38,806,801
34	31,845,093	33,904,252	36,222,456	38,853,567
35	31,877,528	33,940,634	36,263,570	38,900,438
36	31,910,024	33,977,088	36,304,771	38,947,416
37	31,942,580	34,013,615	36,346,060	38,994,501
38	31,975,197	34,050,215	36,387,437	39,041,695
39	32,007,875	34,086,888	36,428,903	39,088,998
40	32,040,613	34,123,634	36,470,459	39,136,409
41	32,073,413	34,160,453	36,512,103	39,183,929
42	32,106,275	34,197,345	36,553,836	39,231,557
43	32,139,200	34,234,310	36,595,659	39,279,294
44	32,172,187	34,271,348	36,637,572	39,327,139
45	32,205,237	34,308,459	36,679,574	39,375,094
46	32,238,349	34,345,644	36,721,666	39,423,158
47	32,271,524	34,382,903	36,763,849	39,471,331
48	32,304,762	34,420,237	36,806,121	39,519,614
49	32,338,064	34,457,647	36,848,483	39,568,006
50	32,371,430	34,495,132	36,890,936	39,616,509
51	32,404,858	34,532,692	36,933,479	39,665,124
52	32,438,348	34,570,327	36,976,114	39,713,852
53	32,471,901	34,608,038	37,018,840	39,762,695
54	32,505,517	34,645,824	37,061,659	39,811,654
55	32,539,196	34,683,686	37,104,570	39,860,729
56	32,572,937	34,721,625	37,147,574	39,909,917
57	32,606,741	34,759,640	37,190,670	39,959,218
58	32,640,607	34,797,733	37,233,859	40,008,633
59	32,674,536	34,835,903	37,277,141	40,058,103
60	32,708,528	34,874,151	37,320,517	40,107,808

D 3

	76	77	78	79
0	40,107,808	43,314,742	47,046,295	51,445,543
1	40,157,569	43,372,301	47,113,680	51,525,561
2	40,207,446	43,430,006	47,181,249	51,605,820
3	40,257,440	43,487,857	47,249,003	51,686,321
4	40,307,552	43,545,855	47,316,942	51,767,065
5	40,357,781	43,604,000	47,385,067	51,848,053
6	40,408,129	43,662,293	47,453,380	51,929,285
7	40,458,596	43,720,733	47,521,882	52,010,762
8	40,509,183	43,779,321	47,590,575	52,092,485
9	40,559,890	43,838,057	47,659,460	52,174,455
10	40,610,718	43,896,942	47,728,538	52,256,673
11	40,661,665	43,955,977	47,797,809	52,339,140
12	40,712,731	44,015,163	47,867,274	52,421,857
13	40,763,917	44,074,501	47,936,934	52,504,826
14	40,815,224	44,133,992	48,006,790	52,588,048
15	40,866,652	44,193,637	48,076,841	52,671,525
16	40,918,201	44,253,435	48,147,088	52,755,259
17	40,969,871	44,313,387	48,217,531	52,839,251
18	41,021,663	44,373,494	48,288,171	52,923,503
19	41,073,577	44,433,756	48,359,008	53,008,016
20	41,125,614	44,494,174	48,430,043	53,092,792
21	41,177,775	44,554,749	48,501,278	53,177,831
22	41,230,062	44,615,481	48,572,714	53,263,134
23	41,282,475	44,676,371	48,644,352	53,348,702
24	41,335,015	44,737,419	48,716,193	53,434,536
25	41,387,683	44,798,626	48,788,238	53,520,637
26	41,440,480	44,859,993	48,860,488	53,607,006
27	41,493,407	44,921,521	48,932,945	53,693,644
28	41,546,464	44,983,211	49,005,610	53,780,552
29	41,599,653	45,045,065	49,078,483	53,867,731
30	41,652,974	45,107,083	49,151,565	53,955,183

TANGENTIVM.

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70	76	77	78	79
30	41,652,974	45,107,083	49,151,565	53,955,183
31	41,706,424	45,169,263	49,224,856	54,042,909
32	41,760,003	45,231,607	49,298,357	54,130,911
33	41,813,712	45,294,114	49,372,069	54,219,190
34	41,867,550	45,356,785	49,445,993	54,307,748
35	41,921,518	45,419,621	49,520,130	54,396,586
36	41,975,617	45,482,623	49,594,481	54,485,705
37	42,029,848	45,545,790	49,669,047	54,575,107
38	42,084,211	45,609,123	49,743,829	54,664,793
39	42,138,706	45,672,623	49,818,827	54,754,764
40	42,193,334	45,736,291	49,894,042	54,845,022
41	42,248,096	45,800,128	49,969,475	54,935,569
42	42,302,993	45,864,135	50,045,127	55,026,406
43	42,358,025	45,928,314	50,120,999	55,117,535
44	42,413,193	45,992,666	50,197,092	55,208,958
45	42,468,497	46,057,192	50,273,407	55,300,676
46	42,523,937	46,121,892	50,349,945	55,392,692
47	42,579,514	46,186,767	50,426,707	55,485,007
48	42,635,228	46,251,817	50,503,695	55,577,622
49	42,691,080	46,317,043	50,580,910	55,670,539
50	42,747,070	46,382,445	50,658,353	55,763,759
51	42,803,199	46,448,023	50,736,025	55,857,283
52	42,859,468	46,513,778	50,813,927	55,951,112
53	42,915,878	46,579,711	50,892,060	56,045,247
54	42,972,429	46,645,823	50,970,425	56,139,689
55	43,029,122	46,712,115	51,049,023	56,234,439
56	43,085,958	46,778,587	51,127,855	56,329,498
57	43,142,937	46,845,240	51,206,922	56,424,868
58	43,200,060	46,912,075	51,286,225	56,520,550
59	43,257,328	46,979,093	51,365,765	56,616,545
60	43,314,742	47,046,295	51,445,543	56,712,854

	80	81	82	83
0	56,712,854	63,137,478	71,153,707	81,445,302
1	56,809,480	63,256,564	71,304,198	81,639,821
2	56,906,425	63,376,089	71,455,313	81,837,074
3	57,003,690	63,496,056	71,607,058	82,035,268
4	57,101,277	63,616,468	71,759,440	82,234,410
5	57,199,188	63,737,327	71,912,459	82,434,508
6	57,297,425	63,858,635	72,066,117	82,635,570
7	57,395,990	63,980,394	72,220,422	82,837,603
8	57,494,885	64,102,607	72,375,376	83,040,614
9	57,594,111	64,225,276	72,530,983	83,244,610
10	57,693,670	64,348,404	72,687,247	83,449,598
11	57,793,564	64,471,994	72,844,173	83,655,585
12	57,893,795	64,596,049	73,001,766	83,862,572
13	57,994,366	64,720,571	73,160,031	84,070,565
14	58,095,279	64,845,563	73,318,972	84,279,571
15	58,196,536	64,971,028	73,478,593	84,489,598
16	58,298,138	65,096,069	73,638,898	84,700,687
17	58,400,087	65,223,388	73,799,892	84,912,817
18	58,502,385	65,350,287	73,961,579	85,125,995
19	58,605,034	65,477,669	74,123,964	85,340,229
20	58,708,035	65,605,537	74,287,052	85,555,525
21	58,811,388	65,733,894	74,450,847	85,771,891
22	58,915,095	65,862,743	74,615,354	85,989,335
23	59,019,157	65,992,087	74,780,577	86,207,866
24	59,123,576	66,121,928	74,946,521	86,427,493
25	59,228,353	66,252,268	75,113,189	86,648,225
26	59,333,490	66,383,110	75,280,586	86,870,072
27	59,438,989	66,514,457	75,448,716	87,093,043
28	59,544,852	66,646,313	75,617,584	87,317,150
29	59,651,081	66,778,681	75,787,195	87,542,404
30	59,757,678	66,911,564	75,957,554	87,768,816

	80	81	82	83
80	59,757,678	66,911,564	75,957,554	87,768,816
81	59,864,646	67,044,965	76,128,666	87,996,394
82	59,971,987	67,178,887	76,300,536	88,225,146
83	60,079,703	67,313,334	76,473,170	88,455,079
84	60,187,796	67,448,309	76,646,573	88,686,196
85	60,296,268	67,583,815	76,820,751	88,918,508
86	60,405,121	67,719,855	76,995,710	89,152,021
87	60,514,358	67,856,423	77,171,455	89,386,745
88	60,623,981	67,993,549	77,347,991	89,622,688
89	60,733,992	68,131,209	77,525,324	89,859,858
90	60,844,392	68,269,416	77,703,459	90,098,268
91	60,955,184	68,408,173	77,882,402	90,337,927
92	61,066,370	68,547,438	78,062,159	90,578,848
93	61,177,952	68,687,350	78,242,737	90,821,043
94	61,289,930	68,827,777	78,424,142	91,064,526
95	61,402,307	68,968,768	78,606,379	91,309,309
96	61,515,085	69,110,326	78,789,454	91,555,401
97	61,628,267	69,252,455	78,973,371	91,802,810
98	61,741,856	69,395,158	79,158,136	92,051,546
99	61,855,854	69,538,439	79,343,754	92,301,618
100	61,970,263	69,682,302	79,530,231	92,553,036
101	62,085,085	69,826,751	79,717,572	92,805,759
102	62,200,323	69,971,789	79,905,783	93,059,875
103	62,315,979	70,117,419	80,094,869	93,315,361
104	62,432,056	70,263,645	80,284,835	93,572,238
105	62,548,556	70,410,470	80,475,688	93,830,595
106	62,665,481	70,557,898	80,667,435	94,090,270
107	62,782,833	70,705,932	80,860,083	94,351,448
108	62,900,615	70,854,576	81,053,639	94,614,055
109	63,018,829	71,003,833	81,248,110	94,878,103
110	63,137,478	71,153,706	81,443,502	95,143,611

	84	85	86
0	95,143,611	114,300,579	143,006,601
1	95,410,585	114,684,819	143,606,943
2	95,679,034	115,071,619	144,212,307
3	95,948,971	115,461,005	144,822,757
4	96,220,411	115,853,017	145,438,358
5	96,493,467	116,247,668	146,059,175
6	96,767,939	116,644,985	146,685,275
7	97,044,063	117,044,995	147,316,726
8	97,321,646	117,447,864	147,953,611
9	97,600,890	117,853,346	148,595,987
10	97,881,716	118,261,757	149,244,148
11	98,164,135	118,672,834	149,897,753
12	98,448,162	119,086,890	150,557,233
13	98,733,810	119,503,669	151,222,301
14	99,021,104	119,923,488	151,893,462
15	99,310,047	120,346,233	152,570,581
16	99,600,655	120,771,937	153,253,487
17	99,893,042	121,200,643	153,942,729
18	100,187,022	121,632,370	154,638,158
19	100,482,822	122,067,151	155,339,855
20	100,780,346	122,505,017	156,047,923
21	101,079,507	122,946,003	156,762,433
22	101,380,525	123,390,142	157,483,474
23	101,683,314	123,837,634	158,211,136
24	101,987,889	124,288,195	158,945,509
25	102,294,266	124,742,169	159,686,753
26	102,602,473	125,199,280	160,434,770
27	102,912,514	125,659,878	161,189,849
28	103,224,405	126,123,842	161,952,305
29	103,538,166	126,591,211	162,721,698
30	103,853,919	127,062,036	163,498,660

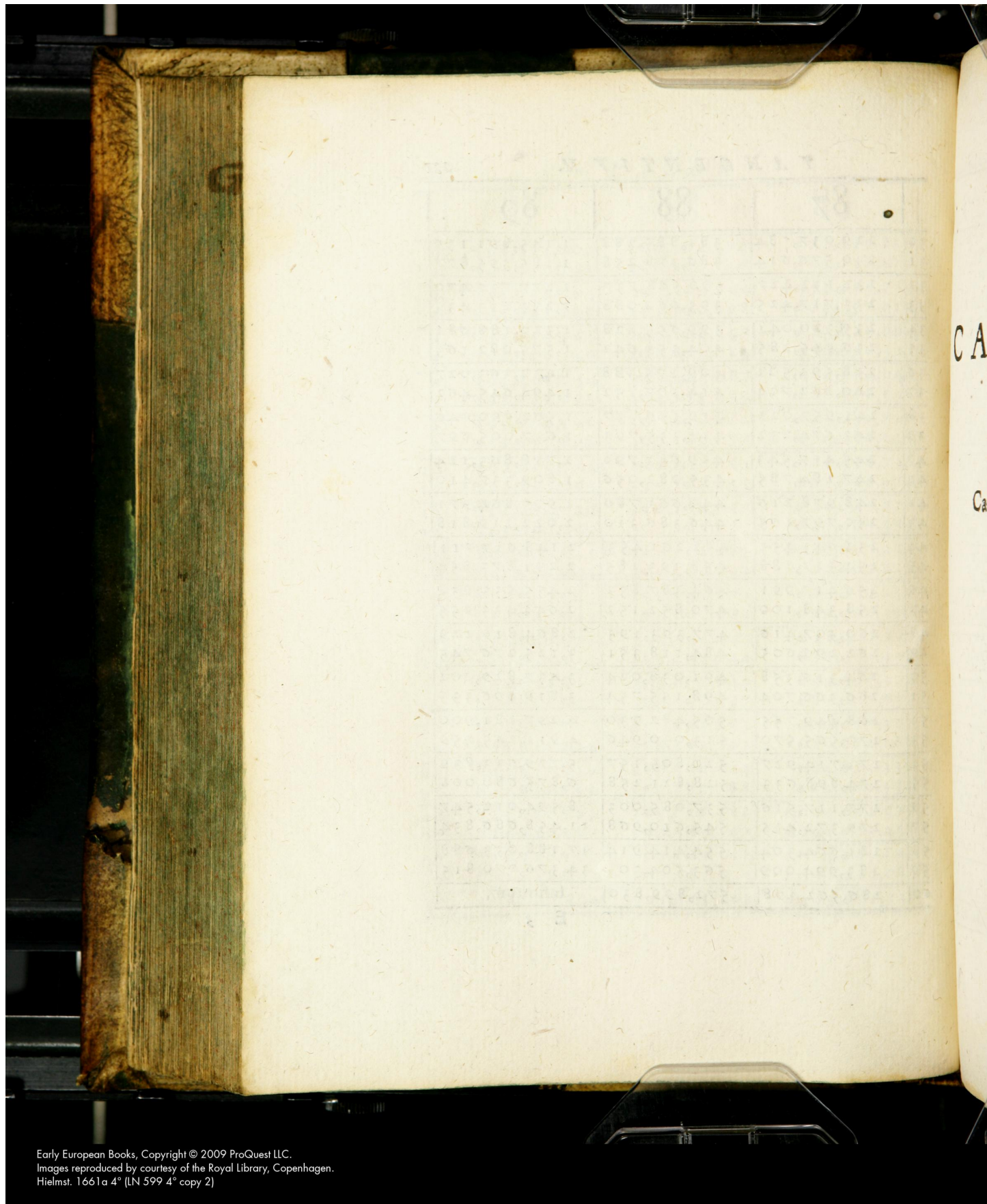
	84	85	86
30	103,853,919	127,062,036	163,498,660
31	104,171,468	127,536,341	164,282,764
32	104,491,055	128,014,165	165,074,651
33	104,812,581	128,495,548	165,873,906
34	105,136,063	128,980,531	166,681,172
35	105,461,519	129,469,305	167,496,287
36	105,788,969	129,961,652	168,319,085
37	106,118,428	130,457,692	169,150,247
38	106,449,917	130,957,670	169,989,613
39	106,783,466	131,461,286	170,837,394
40	107,119,198	131,968,930	171,693,461
41	107,456,902	132,480,297	172,558,198
42	107,796,712	132,995,769	173,431,641
43	108,138,767	133,515,636	174,313,925
44	108,482,852	134,038,804	175,205,183
45	108,829,233	134,566,419	176,105,555
46	109,177,805	135,098,153	177,015,180
47	109,528,589	135,634,096	177,934,219
48	109,881,598	136,174,272	178,862,806
49	110,236,864	136,718,731	179,801,085
50	110,594,415	137,267,523	180,749,537
51	110,954,264	137,820,702	181,707,670
52	111,316,432	138,378,319	182,676,299
53	111,680,940	138,940,429	183,654,941
54	112,047,814	139,507,087	184,644,417
55	112,417,202	140,078,545	185,644,562
56	112,788,878	140,654,481	186,655,202
57	113,163,056	141,235,334	187,677,257
58	113,539,681	141,820,765	188,710,414
59	113,918,875	142,411,234	189,755,028
60	114,300,579	143,006,601	190,811,200

E 2

	87	88	89
0	190,811,200	286,362,498	572,899,830
1	191,879,163	288,770,746	582,610,421
2	192,959,095	291,219,764	592,655,713
3	194,051,200	293,710,598	603,057,015
4	195,155,685	296,244,357	613,825,994
5	196,273,146	298,823,024	624,990,311
6	197,403,054	301,445,987	636,564,040
7	198,545,993	304,115,322	648,578,536
8	199,702,191	306,833,212	661,050,728
9	200,871,878	309,599,077	674,016,435
10	202,055,705	312,416,191	687,500,739
11	203,253,093	315,283,945	701,531,474
12	204,464,726	318,204,757	716,149,676
13	205,691,260	321,181,137	731,385,593
14	206,932,111	324,212,583	747,289,264
15	208,188,402	327,302,782	763,899,813
16	209,459,545	330,451,272	781,259,259
17	210,746,693	333,661,982	799,432,199
18	212,049,271	336,934,467	818,463,792
19	213,363,214	340,272,744	838,430,438
20	214,704,085	343,677,949	859,395,374
21	216,956,022	347,150,587	881,427,652
22	217,425,507	350,695,255	904,627,361
23	218,812,405	354,312,962	929,081,086
24	220,217,049	358,006,024	954,893,332
25	221,639,784	361,776,788	982,180,553
26	223,080,983	365,626,388	1,011,062,679
27	224,540,987	369,560,062	1,041,705,454
28	226,020,167	373,579,199	1,074,263,399
29	227,518,902	377,686,614	1,108,922,084
30	229,037,584	381,885,288	1,145,891,136

	87	88	89
30	229,037,584	381,885,288	1,145,891,136
31	230,576,614	386,178,258	1,185,395,877
32	232,132,427	390,568,737	1,227,736,470
33	233,717,425	395,060,088	1,273,213,435
34	235,320,041	399,655,828	1,322,188,681
35	236,945,285	404,359,642	1,375,082,163
36	238,592,501	409,175,388	1,432,363,027
37	240,262,714	414,107,152	1,494,645,462
38	241,957,021	419,159,137	1,562,590,046
39	243,674,732	424,335,793	1,637,005,697
40	245,417,543	429,641,796	1,718,863,124
41	247,184,785	435,082,056	1,809,337,410
42	248,978,216	440,661,780	1,909,864,971
43	250,797,165	446,386,310	2,022,219,818
44	252,643,455	452,261,453	2,148,619,711
45	254,517,088	458,293,185	2,291,873,854
46	256,417,991	464,487,853	2,455,533,838
47	258,348,100	470,852,152	2,644,433,955
48	260,307,416	477,393,195	2,864,819,229
49	262,296,605	484,118,351	3,125,276,745
50	264,316,358	491,038,024	3,437,829,002
51	266,366,704	498,155,754	3,819,696,333
52	268,449,755	505,482,730	4,297,181,900
53	270,565,570	513,030,946	4,911,245,459
54	272,714,927	520,805,157	5,729,633,839
55	274,898,633	528,821,258	6,875,680,006
56	277,117,516	537,085,003	8,594,012,547
57	279,372,435	545,610,968	11,458,686,834
58	281,664,304	554,414,914	17,188,033,688
59	283,994,009	563,504,309	34,376,070,815
60	286,362,498	572,899,830	Infinitum.

E 3



CANON SE-
cantium.

RHETICO

Canon hypotenusarum.

	0	1	2	3
0	10,000,000	10,001,524	10,006,095	10,013,723
1	10,000,001	10,001,574	10,006,198	10,013,875
2	10,000,002	10,001,626	10,006,301	10,014,029
3	10,000,004	10,001,679	10,006,405	10,014,184
4	10,000,008	10,001,733	10,006,509	10,014,339
5	10,000,010	10,001,788	10,006,615	10,014,495
6	10,000,014	10,001,844	10,006,721	10,014,653
7	10,000,020	10,001,900	10,006,828	10,014,811
8	10,000,027	10,001,957	10,006,936	10,014,970
9	10,000,034	10,002,015	10,007,045	10,015,130
10	10,000,042	10,002,074	10,007,155	10,015,291
11	10,000,051	10,002,134	10,007,265	10,015,453
12	10,000,060	10,002,195	10,007,376	10,015,615
13	10,000,071	10,002,256	10,007,488	10,015,778
14	10,000,083	10,002,318	10,007,601	10,015,942
15	10,000,095	10,002,381	10,007,716	10,016,107
16	10,000,108	10,002,445	10,007,831	10,016,273
17	10,000,122	10,002,510	10,007,946	10,016,440
18	10,000,137	10,002,576	10,008,062	10,016,608
19	10,000,152	10,002,642	10,008,179	10,016,777
20	10,000,168	10,002,709	10,008,298	10,016,946
21	10,000,186	10,002,777	10,008,417	10,017,116
22	10,000,204	10,002,846	10,008,537	10,017,287
23	10,000,223	10,002,916	10,008,658	10,017,459
24	10,000,243	10,002,987	10,008,779	10,017,632
25	10,000,264	10,003,058	10,008,902	10,017,806
26	10,000,285	10,003,130	10,009,025	10,017,981
27	10,000,308	10,003,203	10,009,149	10,018,157
28	10,000,332	10,003,277	10,009,274	10,018,333
29	10,000,357	10,003,352	10,009,400	10,018,510
30	10,000,381	10,003,428	10,009,527	10,018,687

	0	1	2	3
30	10,000,381	10,003,428	10,009,527	10,018,687
31	10,000,407	10,003,505	10,009,655	10,018,865
32	10,000,433	10,003,582	10,009,783	10,019,044
33	10,000,461	10,003,660	10,009,912	10,019,224
34	10,000,489	10,003,739	10,010,043	10,019,405
35	10,000,518	10,003,819	10,010,174	10,019,587
36	10,000,548	10,003,900	10,010,306	10,019,770
37	10,000,579	10,003,982	10,010,439	10,019,954
38	10,000,611	10,004,065	10,010,572	10,020,138
39	10,000,643	10,004,148	10,010,706	10,020,324
40	10,000,677	10,004,232	10,010,841	10,020,510
41	10,000,711	10,004,317	10,010,977	10,020,698
42	10,000,746	10,004,403	10,011,114	10,020,886
43	10,000,782	10,004,490	10,011,252	10,021,086
44	10,000,819	10,004,578	10,011,390	10,021,266
45	10,000,857	10,004,666	10,011,529	10,021,456
46	10,000,895	10,004,755	10,011,670	10,021,649
47	10,000,934	10,004,845	10,011,811	10,021,842
48	10,000,975	10,004,936	10,011,952	10,022,035
49	10,001,016	10,005,028	10,012,098	10,022,239
50	10,001,058	10,005,122	10,012,238	10,022,424
51	10,001,100	10,005,216	10,012,383	10,022,620
52	10,001,144	10,005,310	10,012,528	10,022,817
53	10,001,188	10,005,405	10,012,674	10,023,015
54	10,001,233	10,005,501	10,012,822	10,023,213
55	10,001,280	10,005,598	10,012,970	10,023,412
56	10,001,327	10,005,696	10,013,119	10,023,612
57	10,001,375	10,005,795	10,013,269	10,023,813
58	10,001,423	10,005,894	10,013,419	10,024,014
59	10,001,473	10,005,994	10,013,570	10,024,217
60	10,001,524	10,006,095	10,013,723	10,024,420

F

	4	5	6	7
0	10,024,420	10,038,198	10,055,082	10,075,098
1	10,024,625	10,038,454	10,055,390	10,075,459
2	10,024,830	10,038,710	10,055,699	10,075,820
3	10,025,036	10,038,968	10,056,009	10,076,182
4	10,025,242	10,039,226	10,056,320	10,076,545
5	10,025,450	10,039,486	10,056,632	10,076,909
6	10,025,658	10,039,746	10,056,944	10,077,274
7	10,025,868	10,040,008	10,057,256	10,077,639
8	10,026,078	10,040,269	10,057,570	10,078,005
9	10,026,289	10,040,532	10,057,884	10,078,372
10	10,026,500	10,040,796	10,058,200	10,078,740
11	10,026,713	10,041,061	10,058,517	10,079,009
12	10,026,927	10,041,326	10,058,834	10,079,479
13	10,027,141	10,041,592	10,059,153	10,079,850
14	10,027,357	10,041,859	10,059,472	10,080,222
15	10,027,573	10,042,128	10,059,792	10,080,595
16	10,027,790	10,042,397	10,060,113	10,080,968
17	10,028,009	10,042,667	10,060,435	10,081,332
18	10,028,227	10,042,936	10,060,757	10,081,717
19	10,028,447	10,043,207	10,061,080	10,082,093
20	10,028,667	10,043,479	10,061,405	10,082,470
21	10,028,889	10,043,752	10,061,730	10,082,848
22	10,029,111	10,044,025	10,062,056	10,083,226
23	10,029,334	10,044,300	10,062,383	10,083,606
24	10,029,559	10,044,576	10,062,711	10,083,987
25	10,029,784	10,044,853	10,063,039	10,084,368
26	10,030,009	10,045,130	10,063,369	10,084,750
27	10,030,236	10,045,409	10,063,700	10,085,134
28	10,030,463	10,045,689	10,064,031	10,085,518
29	10,030,692	10,045,969	10,064,364	10,085,903
30	10,030,920	10,046,250	10,064,696	10,086,289

	4	5	6	7
30	10,030,920	10,046,250	10,064,696	10,086,289
31	10,031,150	10,046,532	10,065,035	10,086,677
32	10,031,381	10,046,815	10,065,365	10,087,065
33	10,031,614	10,047,098	10,065,701	10,087,454
34	10,031,846	10,047,383	10,066,038	10,087,843
35	10,032,079	10,047,669	10,066,376	10,088,243
36	10,032,314	10,047,954	10,066,715	10,088,623
37	10,032,550	10,048,241	10,067,054	10,089,015
38	10,032,786	10,048,529	10,067,394	10,089,408
39	10,033,023	10,048,818	10,067,735	10,089,802
40	10,033,261	10,049,107	10,068,076	10,090,196
41	10,033,500	10,049,398	10,068,419	10,090,592
42	10,033,740	10,049,690	10,068,763	10,090,988
43	10,033,981	10,049,983	10,069,107	10,091,385
44	10,034,223	10,050,276	10,069,452	10,091,783
45	10,034,465	10,050,571	10,069,808	10,092,182
46	10,034,708	10,050,865	10,070,155	10,092,582
47	10,034,952	10,051,160	10,070,493	10,092,983
48	10,035,196	10,051,456	10,070,842	10,093,385
49	10,035,441	10,051,753	10,071,192	10,093,787
50	10,035,688	10,052,051	10,071,543	10,094,190
51	10,035,936	10,052,350	10,071,895	10,094,624
52	10,036,184	10,052,649	10,072,247	10,095,030
53	10,036,434	10,052,951	10,072,600	10,095,406
54	10,036,684	10,053,252	10,072,954	10,095,813
55	10,036,934	10,053,555	10,073,310	10,096,221
56	10,037,185	10,053,858	10,073,666	10,096,630
57	10,037,438	10,054,162	10,074,023	10,097,040
58	10,037,690	10,054,468	10,074,380	10,097,451
59	10,037,944	10,054,775	10,074,737	10,097,863
60	10,038,198	10,055,082	10,075,098	10,098,275

	8	9	10	11
0	10,098,275	10,124,650	10,154,264	10,187,166
1	10,098,698	10,125,117	10,154,786	10,187,743
2	10,099,103	10,125,585	10,155,308	10,188,320
3	10,099,518	10,126,054	10,155,831	10,188,899
4	10,099,934	10,126,524	10,156,356	10,189,478
5	10,100,351	10,126,994	10,156,881	10,190,058
6	10,100,769	10,127,465	10,157,407	10,190,639
7	10,101,188	10,127,947	10,157,934	10,191,221
8	10,101,607	10,128,410	10,158,462	10,191,804
9	10,102,028	10,128,884	10,158,991	10,192,387
10	10,102,450	10,129,358	10,159,520	10,192,972
11	10,102,872	10,129,834	10,160,051	10,193,557
12	10,103,295	10,130,311	10,160,582	10,194,144
13	10,103,720	10,130,788	10,161,114	10,194,732
14	10,104,144	10,131,266	10,161,648	10,195,320
15	10,104,570	10,131,746	10,162,182	10,195,910
16	10,104,996	10,132,226	10,162,707	10,196,500
17	10,105,423	10,132,707	10,163,252	10,197,092
18	10,105,851	10,133,189	10,163,789	10,197,684
19	10,106,286	10,133,672	10,164,327	10,198,277
20	10,106,710	10,134,156	10,165,865	10,198,872
21	10,107,140	10,134,641	10,165,405	10,199,467
22	10,107,572	10,135,127	10,165,944	10,200,063
23	10,108,005	10,135,614	10,166,485	10,200,660
24	10,108,438	10,136,102	10,167,028	10,201,258
25	10,108,873	10,136,591	10,167,571	10,201,857
26	10,109,309	10,137,080	10,168,116	10,202,457
27	10,109,755	10,137,571	10,168,661	10,203,058
28	10,110,182	10,138,163	10,169,207	10,203,659
29	10,110,620	10,138,555	10,169,765	10,204,262
30	10,111,059	10,139,048	10,170,303	10,204,867

II	8	9	10	II
30	10,111,059	10,139,048	10,170,303	10,204,867
31	10,111,509	10,139,543	10,170,852	10,209,470
32	10,111,940	10,140,038	10,171,401	10,200,075
33	10,112,482	10,140,534	10,171,952	10,206,681
34	10,112,825	10,141,036	10,172,504	10,207,289
35	10,113,279	10,141,528	10,173,056	10,207,897
36	10,113,713	10,142,027	10,173,609	10,208,506
37	10,114,159	10,142,526	10,174,163	10,209,116
38	10,114,606	10,143,026	10,174,718	10,209,727
39	10,115,053	10,143,528	10,175,274	10,210,339
40	10,115,501	10,144,030	10,175,831	10,210,952
41	10,115,951	10,144,533	10,176,389	10,211,566
42	10,116,401	10,145,037	10,176,947	10,211,180
43	10,116,852	10,145,542	10,177,507	10,212,796
44	10,117,303	10,146,048	10,178,068	10,213,412
45	10,117,754	10,146,554	10,178,630	10,214,030
46	10,118,209	10,147,062	10,179,193	10,214,668
47	10,118,663	10,147,572	10,179,756	10,215,268
48	10,119,118	10,148,082	10,180,321	10,215,889
49	10,119,574	10,148,593	10,180,886	10,216,510
50	10,120,031	10,149,104	10,181,453	10,217,113
51	10,120,489	10,149,615	10,182,021	10,217,756
52	10,120,948	10,150,128	10,182,589	10,218,380
53	10,121,408	10,150,642	10,183,158	10,219,015
54	10,121,868	10,151,156	10,183,728	10,219,631
55	10,122,330	10,151,672	10,184,299	10,220,258
56	10,122,792	10,152,188	10,184,870	10,220,885
57	10,123,256	10,152,705	10,185,443	10,221,514
58	10,123,720	10,153,224	10,186,017	10,222,143
59	10,124,275	10,153,744	10,186,591	10,222,774
60	10,124,650	10,154,264	10,187,166	10,223,405

F 3

	I2	I3	I4	I5
0	10,223,405	10,263,040	10,306,136	10,352,762
1	10,224,037	10,263,730	10,306,884	10,353,569
2	10,224,671	10,264,420	10,307,633	10,354,377
3	10,225,305	10,265,112	10,308,383	10,355,186
4	10,225,941	10,265,804	10,309,134	10,355,996
5	10,226,577	10,266,498	10,309,886	10,356,807
6	10,227,215	10,267,192	10,310,639	10,357,619
7	10,227,854	10,267,888	10,311,393	10,358,433
8	10,228,493	10,268,584	10,312,148	10,359,247
9	10,229,134	10,269,281	10,312,903	10,360,063
10	10,229,775	10,269,979	10,313,660	10,360,880
11	10,230,417	10,270,688	10,314,417	10,361,698
12	10,231,060	10,271,379	10,315,176	10,362,517
13	10,231,644	10,272,080	10,315,935	10,363,337
14	10,232,288	10,272,782	10,316,696	10,364,158
15	10,232,994	10,273,485	10,317,457	10,364,980
16	10,233,641	10,274,190	10,318,220	10,365,802
17	10,234,289	10,274,895	10,318,984	10,366,626
18	10,234,938	10,275,601	10,319,749	10,367,450
19	10,235,587	10,276,318	10,320,525	10,368,276
20	10,236,238	10,277,016	10,321,282	10,369,102
21	10,236,889	10,277,726	10,322,050	10,369,930
22	10,237,541	10,278,436	10,322,819	10,370,758
23	10,238,195	10,279,148	10,323,589	10,371,588
24	10,238,849	10,279,860	10,324,359	10,372,418
25	10,239,505	10,280,573	10,325,131	10,373,250
26	10,240,161	10,281,287	10,325,903	10,374,092
27	10,240,818	10,282,002	10,326,677	10,374,916
28	10,241,476	10,282,717	10,327,451	10,375,750
29	10,242,135	10,283,434	10,328,127	10,376,586
30	10,242,795	10,284,151	10,329,003	10,377,422

	12	13	14	15
30	10,242,795	10,284,151	10,329,003	10,377,422
31	10,243,456	10,284,870	10,329,381	10,378,260
32	10,244,118	10,285,589	10,330,552	10,379,098
33	10,245,782	10,286,310	10,331,339	10,379,938
34	10,245,445	10,287,032	10,332,119	10,380,778
35	10,246,110	10,287,754	10,332,902	10,381,620
36	10,246,776	10,288,478	10,333,684	10,382,463
37	10,247,442	10,289,202	10,334,467	10,383,307
38	10,248,110	10,289,928	10,335,252	10,384,153
39	10,248,778	10,290,654	10,336,037	10,384,999
40	10,249,448	10,291,381	10,336,824	10,385,846
41	10,250,119	10,292,119	10,337,612	10,386,694
42	10,250,790	10,292,838	10,338,400	10,387,543
43	10,251,461	10,293,569	10,339,189	10,388,393
44	10,252,136	10,294,300	10,339,980	10,389,244
45	10,252,811	10,295,043	10,340,771	10,390,096
46	10,253,482	10,295,766	10,341,564	10,390,949
47	10,254,162	10,296,501	10,342,347	10,391,803
48	10,254,839	10,297,237	10,343,152	10,392,657
49	10,255,517	10,297,973	10,343,947	10,393,513
50	10,256,196	10,298,710	10,344,743	10,394,370
51	10,256,876	10,299,449	10,345,541	10,395,228
52	10,257,557	10,300,188	10,346,340	10,396,087
53	10,258,239	10,300,928	10,347,139	10,396,947
54	10,258,922	10,301,669	10,347,940	10,397,808
55	10,259,606	10,302,411	10,348,741	10,398,670
56	10,260,291	10,303,154	10,349,544	10,399,533
57	10,260,977	10,303,898	10,350,347	10,400,397
58	10,261,661	10,304,643	10,351,151	10,401,262
59	10,262,351	10,305,390	10,351,956	10,402,128
60	10,263,040	10,306,136	10,352,762	10,402,994

	16	17	18	19
0	10,402,994	10,456,917	10,514,621	10,576,207
1	10,403,862	10,457,847	10,515,616	10,577,267
2	10,404,730	10,458,779	10,516,612	10,578,328
3	10,405,590	10,459,711	10,517,609	10,579,400
4	10,406,471	10,460,645	10,518,607	10,580,463
5	10,407,343	10,461,580	10,519,606	10,581,518
6	10,408,216	10,462,516	10,520,606	10,582,583
7	10,409,091	10,463,453	10,521,607	10,583,650
8	10,409,966	10,464,391	10,522,608	10,584,717
9	10,410,843	10,465,330	10,523,611	10,585,795
10	10,411,721	10,466,270	10,524,615	10,586,855
11	10,412,600	10,467,211	10,525,620	10,587,925
12	10,413,479	10,468,153	10,526,626	10,588,997
13	10,414,360	10,469,096	10,527,633	10,590,070
14	10,415,241	10,470,041	10,528,642	10,591,145
15	10,416,124	10,470,986	10,529,651	10,592,220
16	10,417,007	10,471,933	10,530,662	10,593,297
17	10,417,892	10,472,880	10,531,673	10,594,375
18	10,418,778	10,473,829	10,532,686	10,595,455
19	10,419,665	10,474,778	10,533,699	10,596,534
20	10,420,553	10,475,729	10,534,714	10,597,615
21	10,421,442	10,476,680	10,535,730	10,598,697
22	10,422,333	10,477,633	10,536,747	10,599,780
23	10,423,224	10,478,587	10,537,765	10,600,865
24	10,424,116	10,479,542	10,538,785	10,601,950
25	10,425,009	10,480,498	10,539,805	10,603,037
26	10,425,903	10,481,454	10,540,826	10,604,125
27	10,426,798	10,482,412	10,541,848	10,605,214
28	10,427,694	10,483,371	10,542,872	10,606,304
29	10,428,591	10,484,331	10,543,897	10,607,395
30	10,429,489	10,485,292	10,544,923	10,608,487

	16	17	18	19
30	10,429,489	10,485,292	10,544,923	10,608,487
31	10,430,388	10,486,254	10,545,950	10,609,580
32	10,431,288	10,487,217	10,546,977	10,610,675
33	10,432,189	10,488,181	10,548,006	10,611,770
34	10,433,091	10,489,146	10,549,036	10,612,867
35	10,433,995	10,490,113	10,550,067	10,613,964
36	10,434,899	10,491,080	10,551,099	10,615,063
37	10,435,805	10,492,049	10,552,133	10,616,163
38	10,436,711	10,493,018	10,553,168	10,617,264
39	10,437,619	10,493,989	10,554,204	10,618,366
40	10,438,528	10,494,961	10,555,241	10,619,469
41	10,439,436	10,495,934	10,556,279	10,620,574
42	10,440,346	10,496,908	10,557,318	10,621,680
43	10,441,257	10,497,883	10,558,359	10,622,787
44	10,442,170	10,498,859	10,559,400	10,623,895
45	10,443,083	10,499,836	10,560,443	10,625,004
46	10,443,998	10,500,814	10,561,490	10,626,114
47	10,444,913	10,501,793	10,562,531	10,627,226
48	10,445,830	10,502,773	10,563,577	10,628,338
49	10,446,749	10,503,754	10,564,623	10,629,451
50	10,447,668	10,504,736	10,565,670	10,630,566
51	10,448,588	10,505,719	10,566,719	10,631,682
52	10,449,509	10,506,704	10,567,769	10,632,799
53	10,450,431	10,507,689	10,568,820	10,633,917
54	10,451,354	10,508,676	10,569,872	10,635,037
55	10,452,279	10,509,664	10,570,925	10,636,157
56	10,453,204	10,510,653	10,571,980	10,637,279
57	10,454,131	10,511,643	10,573,034	10,638,402
58	10,455,058	10,512,635	10,574,091	10,639,526
59	10,455,987	10,513,627	10,575,149	10,640,651
60	10,456,917	10,514,621	10,576,207	10,641,777

G

	20	21	22	23
0	10,641,777	10,711,449	10,785,347	10,863,603
1	10,642,905	10,712,646	10,786,516	10,864,945
2	10,644,034	10,713,888	10,787,885	10,866,289
3	10,645,164	10,715,042	10,789,155	10,867,633
4	10,646,295	10,716,242	10,790,427	10,868,979
5	10,647,427	10,717,444	10,791,700	10,870,326
6	10,648,560	10,718,647	10,792,974	10,871,675
7	10,649,694	10,719,850	10,794,250	10,873,024
8	10,650,829	10,721,056	10,795,527	10,874,374
9	10,651,965	10,722,261	10,796,805	10,875,626
10	10,653,103	10,723,469	10,798,085	10,877,079
11	10,654,242	10,724,677	10,799,365	10,878,434
12	10,655,381	10,725,887	10,800,647	10,879,790
13	10,656,522	10,727,098	10,801,930	10,881,147
14	10,657,664	10,728,310	10,803,214	10,882,506
15	10,658,807	10,729,524	10,804,500	10,883,865
16	10,659,951	10,730,738	10,805,787	10,885,226
17	10,661,097	10,731,953	10,807,074	10,886,588
18	10,662,244	10,733,170	10,808,363	10,887,952
19	10,663,392	10,734,387	10,809,652	10,889,317
20	10,664,541	10,735,606	10,810,942	10,890,683
21	10,665,692	10,736,826	10,812,234	10,892,051
22	10,666,844	10,738,048	10,813,528	10,893,417
23	10,667,996	10,739,270	10,814,823	10,894,788
24	10,669,150	10,740,494	10,816,119	10,896,159
25	10,670,304	10,741,719	10,817,417	10,897,531
26	10,671,460	10,742,945	10,818,715	10,898,905
27	10,672,617	10,744,173	10,820,015	10,900,280
28	10,673,776	10,745,401	10,821,316	10,901,656
29	10,674,936	10,746,631	10,822,617	10,903,033
30	10,676,096	10,747,864	10,823,920	10,904,413

SECANTIVM.

235

	20	21	22	23
30	10,676,096	10,747,864	10,823,920	10,904,413
31	10,677,258	10,749,094	10,825,225	10,905,790
32	10,678,420	10,750,327	10,826,531	10,907,171
33	10,679,584	10,751,561	10,827,838	10,908,553
34	10,680,749	10,752,797	10,829,146	10,909,936
35	10,681,915	10,754,034	10,830,455	10,911,322
36	10,683,082	10,755,273	10,831,766	10,912,709
37	10,684,250	10,756,513	10,833,078	10,914,096
38	10,685,420	10,757,753	10,834,391	10,915,484
39	10,686,591	10,758,995	10,835,706	10,916,874
40	10,687,763	10,760,237	10,837,023	10,918,265
41	10,688,936	10,761,481	10,838,341	10,919,657
42	10,690,111	10,762,726	10,839,660	10,921,051
43	10,691,287	10,763,972	10,840,980	10,922,436
44	10,692,464	10,765,220	10,842,301	10,923,833
45	10,693,642	10,766,469	10,843,623	10,925,241
46	10,694,821	10,767,720	10,844,947	10,926,641
47	10,696,001	10,768,971	10,846,272	10,928,041
48	10,697,182	10,770,224	10,847,597	10,929,442
49	10,698,364	10,771,477	10,848,924	10,930,846
50	10,699,548	10,772,732	10,850,252	10,932,249
51	10,700,732	10,773,988	10,851,583	10,933,654
52	10,701,918	10,775,244	10,852,914	10,935,061
53	10,703,105	10,776,502	10,854,246	10,936,469
54	10,704,294	10,777,761	10,855,578	10,937,879
55	10,705,483	10,779,022	10,856,912	10,939,290
56	10,706,674	10,780,284	10,858,247	10,940,702
57	10,707,866	10,781,547	10,859,584	10,942,115
58	10,709,059	10,782,802	10,860,922	10,943,527
59	10,710,254	10,784,078	10,862,262	10,944,945
60	10,711,449	10,785,347	10,863,603	10,946,362

G 2

	24	25	26	27
0	10,946,362	11,033,783	11,126,021	11,223,262
1	10,947,781	11,035,280	11,127,601	11,224,927
2	10,949,201	11,036,779	11,129,182	11,226,593
3	10,950,622	11,038,279	11,130,765	11,228,260
4	10,952,045	11,039,780	11,132,349	11,229,929
5	10,953,469	11,041,283	11,133,933	11,231,599
6	10,954,894	11,042,787	11,135,519	11,233,270
7	10,956,320	11,044,293	11,137,106	11,234,943
8	10,957,747	11,045,799	11,138,694	11,236,617
9	10,959,175	11,047,306	11,140,284	11,238,292
10	10,960,605	11,048,815	11,141,875	11,239,969
11	10,962,036	11,050,325	11,143,467	11,241,648
12	10,963,469	11,051,837	11,145,061	11,243,329
13	10,964,903	11,053,350	11,146,656	11,245,011
14	10,966,338	11,054,865	11,148,254	11,246,694
15	10,967,775	11,056,381	11,149,853	11,248,378
16	10,969,213	11,057,898	11,151,453	11,250,064
17	10,970,652	11,059,420	11,153,055	11,251,751
18	10,972,092	11,060,939	11,154,658	11,253,440
19	10,973,533	11,062,461	11,156,262	11,255,130
20	10,974,976	11,063,985	11,157,868	11,256,822
21	10,976,420	11,065,510	11,159,475	11,258,516
22	10,977,865	11,067,037	11,161,084	11,260,211
23	10,979,312	11,068,564	11,162,694	11,261,907
24	10,980,760	11,070,092	11,164,306	11,263,605
25	10,982,210	11,071,621	11,165,919	11,265,304
26	10,983,661	11,073,152	11,167,533	11,267,005
27	10,985,113	11,074,684	11,169,149	11,268,707
28	10,986,567	11,076,218	11,170,766	11,270,410
29	10,988,022	11,077,753	11,172,385	11,272,114
30	10,989,480	11,079,289	11,174,006	11,273,820

	24	25	26	27
30	10,989,480	11,079,289	11,174,006	11,273,820
31	10,990,938	11,080,827	11,175,627	11,275,528
32	10,992,398	11,082,366	11,177,249	11,277,238
33	10,993,859	11,083,906	11,178,873	11,278,949
34	10,995,321	11,085,448	11,180,499	11,280,661
35	10,996,783	11,086,990	11,182,125	11,282,374
36	10,998,247	11,088,536	11,183,753	11,284,089
37	10,999,712	11,090,082	11,185,383	11,285,805
38	11,001,179	11,091,629	11,187,014	11,287,524
39	11,002,647	11,093,178	11,188,647	11,289,244
40	11,004,116	11,094,729	11,190,281	11,290,965
41	11,005,587	11,096,280	11,191,916	11,292,688
42	11,007,059	11,097,833	11,193,553	11,294,412
43	11,008,533	11,099,387	11,195,191	11,296,132
44	11,010,008	11,100,943	11,196,831	11,297,864
45	11,011,484	11,102,500	11,198,472	11,299,593
46	11,012,962	11,104,058	11,200,114	11,301,324
47	11,014,441	11,105,618	11,203,758	11,303,056
48	11,015,921	11,107,179	11,203,404	11,304,789
49	11,017,402	11,108,741	11,205,051	11,306,523
50	11,018,884	11,110,306	11,206,700	11,308,259
51	11,020,367	11,111,871	11,208,350	11,309,996
52	11,021,852	11,113,438	11,210,001	11,311,735
53	11,023,338	11,115,006	11,211,654	11,313,476
54	11,024,826	11,116,575	11,213,308	11,315,218
55	11,026,315	11,118,145	11,214,963	11,316,961
56	11,027,806	11,119,717	11,216,620	11,318,706
57	11,029,298	11,121,290	11,218,278	11,319,452
58	11,030,791	11,122,865	11,219,938	11,322,199
59	11,032,287	11,124,442	11,221,599	11,323,949
60	11,033,783	11,126,021	11,223,262	11,325,700

G 3

	28	29	30	31
0	11,325,700	11,433,540	11,547,004	11,666,331
1	11,327,452	11,435,384	11,548,944	11,668,371
2	11,329,206	11,437,230	11,550,886	11,670,413
3	11,330,961	11,439,078	11,552,829	11,672,457
4	11,332,718	11,440,927	11,554,774	11,674,502
5	11,334,479	11,442,777	11,556,720	11,676,548
6	11,336,237	11,444,629	11,558,669	11,678,597
7	11,337,999	11,446,483	11,560,619	11,680,647
8	11,339,762	11,448,339	11,562,570	11,682,698
9	11,341,526	11,450,196	11,564,523	11,684,752
10	11,343,292	11,452,054	11,566,480	11,686,807
11	11,345,060	11,453,915	11,568,434	11,688,864
12	11,346,830	11,455,776	11,570,393	11,690,923
13	11,348,601	11,457,639	11,572,353	11,692,984
14	11,350,373	11,459,503	11,574,314	11,695,046
15	11,352,149	11,461,370	11,576,277	11,697,110
16	11,353,923	11,463,238	11,578,242	11,699,176
17	11,355,698	11,465,107	11,580,208	11,701,243
18	11,357,475	11,466,978	11,582,175	11,703,312
19	11,359,255	11,468,850	11,584,145	11,705,383
20	11,361,036	11,470,723	11,586,116	11,707,455
21	11,362,819	11,472,599	11,588,089	11,709,530
22	11,364,603	11,474,483	11,590,064	11,711,606
23	11,366,389	11,476,354	11,592,040	11,713,684
24	11,368,177	11,478,235	11,594,018	11,715,764
25	11,369,966	11,480,117	11,595,998	11,717,845
26	11,371,756	11,482,001	11,597,979	11,719,928
27	11,373,548	11,483,887	11,599,961	11,722,012
28	11,375,341	11,485,774	11,601,946	11,724,099
29	11,377,136	11,487,662	11,603,932	11,726,187
30	11,378,933	11,489,553	11,605,919	11,728,276

	28	29	30	31
30	11,378,933	11,489,353	11,605,919	11,728,276
31	11,380,731	11,491,445	11,607,909	11,730,367
32	11,382,530	11,493,338	11,609,900	11,732,460
33	11,384,331	11,495,233	11,611,893	11,734,555
34	11,386,134	11,497,140	11,613,888	11,736,652
35	11,387,938	11,499,028	11,615,876	11,738,751
36	11,389,744	11,500,928	11,617,882	11,740,851
37	11,391,551	11,502,829	11,619,881	11,742,953
38	11,393,359	11,504,731	11,621,882	11,745,057
39	11,395,169	11,506,626	11,623,885	11,747,162
40	11,396,981	11,508,532	11,625,889	11,749,269
41	11,398,794	11,510,450	11,627,996	11,751,378
42	11,400,609	11,512,360	11,629,904	11,753,489
43	11,402,425	11,514,271	11,631,913	11,755,603
44	11,404,243	11,516,183	11,633,924	11,757,718
45	11,406,063	11,518,097	11,635,937	11,759,834
46	11,407,884	11,520,013	11,637,952	11,761,951
47	11,409,706	11,521,930	11,639,968	11,764,069
48	11,411,530	11,523,849	11,641,986	11,766,190
49	11,413,356	11,525,770	11,644,005	11,768,312
50	11,415,183	11,527,692	11,646,026	11,770,437
51	11,417,012	11,529,616	11,648,049	11,772,564
52	11,418,842	11,531,542	11,650,075	11,774,696
53	11,420,673	11,533,469	11,652,099	11,776,822
54	11,422,507	11,535,398	11,654,127	11,778,954
55	11,424,342	11,537,328	11,656,156	11,781,088
56	11,426,178	11,539,260	11,658,188	11,783,223
57	11,428,016	11,541,193	11,660,221	11,785,361
58	11,429,856	11,543,128	11,662,256	11,787,500
59	11,431,689	11,545,065	11,664,292	11,789,640
60	11,433,540	11,547,004	11,666,331	11,791,783

	32	33	34	35
0	11,791,783	11,923,633	12,062,179	12,207,745
1	11,793,927	11,925,886	12,064,546	12,210,233
2	11,796,073	11,928,141	12,066,916	12,212,723
3	11,798,221	11,930,397	12,069,286	12,215,214
4	11,800,371	11,932,656	12,071,660	12,217,708
5	11,802,522	11,934,917	12,074,036	12,220,204
6	11,804,675	11,937,180	12,076,413	12,222,702
7	11,806,830	11,939,445	12,078,792	12,225,201
8	11,808,987	11,941,701	12,081,174	12,227,703
9	11,811,145	11,943,979	12,083,558	12,230,207
10	11,813,306	11,946,250	12,085,943	12,232,713
11	11,815,468	11,948,522	12,088,330	12,235,221
12	11,817,632	11,950,796	12,090,720	12,237,732
13	11,819,797	11,953,071	12,093,111	12,240,245
14	11,821,965	11,955,349	12,095,504	12,242,759
15	11,824,134	11,957,629	12,097,899	12,245,275
16	11,826,306	11,959,910	12,100,296	12,247,794
17	11,828,479	11,962,194	12,102,696	12,250,315
18	11,830,654	11,964,479	12,105,097	12,252,837
19	11,832,830	11,966,766	12,107,500	12,255,361
20	11,835,008	11,969,055	12,109,905	12,257,888
21	11,837,188	11,971,346	12,112,312	12,260,417
22	11,839,369	11,973,638	12,114,722	12,262,948
23	11,841,552	11,975,932	12,117,133	12,265,481
24	11,843,737	11,978,229	12,119,546	12,268,016
25	11,845,924	11,980,527	12,121,960	12,270,553
26	11,848,114	11,982,828	12,124,377	12,273,093
27	11,850,305	11,985,131	12,126,796	12,275,634
28	11,852,498	11,987,435	12,129,216	12,278,187
29	11,854,693	11,989,741	12,131,638	12,280,722
30	11,856,890	11,992,050	12,134,063	12,283,270

	32	33	34	35
30	11,856,890	11,992,050	12,134,063	12,283,270
31	11,859,088	11,994,360	12,136,490	12,285,820
32	11,861,288	11,996,672	12,138,919	12,288,372
33	11,863,489	11,998,986	12,141,350	12,290,925
34	11,865,693	12,001,303	12,143,783	12,293,481
35	11,867,899	12,003,619	12,146,218	12,296,039
36	11,870,107	12,005,938	12,148,656	12,298,599
37	11,872,316	12,008,259	12,150,095	12,301,161
38	11,874,527	12,010,582	12,153,536	12,303,725
39	11,876,739	12,012,907	12,155,978	12,306,291
40	11,878,954	12,015,233	12,158,423	12,308,859
41	11,881,171	12,017,562	12,160,870	12,311,430
42	11,883,389	12,019,893	12,163,319	12,314,003
43	11,885,609	12,022,226	12,165,770	12,316,578
44	11,887,831	12,024,560	12,168,223	12,319,156
45	11,890,054	12,026,897	12,170,677	12,321,736
46	11,892,280	12,029,236	12,173,135	12,324,317
47	11,894,508	12,031,576	12,175,594	12,326,900
48	11,896,737	12,033,919	12,178,055	12,329,486
49	11,898,968	12,036,264	12,180,518	12,332,074
50	11,901,202	12,038,610	12,182,983	12,334,664
51	11,903,437	12,040,958	12,185,450	12,337,256
52	11,905,674	12,043,309	12,187,919	12,339,851
53	11,907,912	12,045,661	12,190,390	12,342,448
54	11,910,153	12,048,016	12,192,864	12,345,046
55	11,912,395	12,050,372	12,195,340	12,347,646
56	11,914,640	12,052,730	12,197,817	12,350,249
57	11,916,886	12,055,089	12,200,296	12,352,854
58	11,919,133	12,057,451	12,202,777	12,355,460
59	11,921,382	12,059,814	12,205,260	12,358,068
60	11,923,633	12,062,179	12,207,745	12,360,678

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	36	37	38	39
0	12,360,678	12,521,357	12,690,184	12,867,599
1	12,363,290	12,524,103	12,693,070	12,870,632
2	12,365,906	12,526,851	12,695,957	12,873,667
3	12,368,524	12,529,601	12,698,847	12,876,704
4	12,371,144	12,532,354	12,701,739	12,879,744
5	12,373,766	12,535,110	12,704,634	12,882,787
6	12,376,391	12,537,867	12,707,531	12,885,832
7	12,379,018	12,540,627	12,710,430	12,888,879
8	12,381,647	12,543,389	12,713,332	12,891,929
9	12,384,278	12,546,152	12,716,236	12,894,982
10	12,386,911	12,548,918	12,719,143	12,898,037
11	12,389,546	12,551,686	12,722,052	12,901,094
12	12,392,183	12,554,456	12,724,964	12,904,155
13	12,394,822	12,557,229	12,727,878	12,907,218
14	12,397,464	12,560,005	12,730,794	12,910,283
15	12,400,108	12,562,783	12,733,713	12,913,351
16	12,402,754	12,565,563	12,736,635	12,916,422
17	12,405,402	12,568,345	12,739,559	12,919,494
18	12,408,053	12,571,130	12,742,485	12,922,569
19	12,410,705	12,573,917	12,745,413	12,925,647
20	12,413,359	12,576,706	12,748,344	12,928,727
21	12,416,015	12,579,597	12,751,277	12,931,809
22	12,418,674	12,582,912	12,754,213	12,934,895
23	12,421,335	12,585,087	12,757,151	12,937,983
24	12,423,998	12,587,885	12,760,092	12,941,073
25	12,426,663	12,590,685	12,763,035	12,944,166
26	12,429,331	12,593,488	12,765,981	12,947,262
27	12,432,001	12,596,293	12,768,929	12,950,360
28	12,434,673	12,599,101	12,771,880	12,953,461
29	12,437,348	12,601,911	12,774,833	12,956,565
30	12,440,024	12,604,724	12,777,788	12,959,671

SECANTIVM.

243

	36	37	38	39
30	12,440,024	12,604,724	12,777,788	12,959,671
31	12,442,702	12,607,539	12,786,746	12,962,780
32	12,445,383	12,610,356	12,783,707	12,965,892
33	12,448,066	12,613,175	12,786,670	12,969,007
34	12,450,751	12,615,997	12,789,635	12,972,124
35	12,453,438	12,618,821	12,792,602	12,975,243
36	12,456,128	12,621,648	12,795,573	12,978,366
37	12,458,821	12,624,477	12,798,546	12,981,491
38	12,461,516	12,627,308	12,801,521	12,984,618
39	12,464,213	12,630,141	12,804,498	12,987,747
40	12,466,913	12,632,977	12,807,478	12,990,880
41	12,469,614	12,635,815	12,810,460	12,994,015
42	12,472,317	12,638,655	12,813,445	12,997,153
43	12,475,022	12,641,597	12,816,432	12,000,293
44	12,477,730	12,644,343	12,819,422	13,003,436
45	12,480,440	12,646,191	12,822,415	13,006,582
46	12,483,152	12,650,041	12,825,410	13,009,730
47	12,485,866	12,652,893	12,828,407	13,012,881
48	12,488,583	12,655,748	12,831,407	13,016,034
49	12,491,302	12,658,605	12,834,409	13,019,189
50	12,494,022	12,661,464	12,837,414	13,022,348
51	12,496,744	12,664,325	12,840,421	13,025,509
52	12,499,469	12,667,189	12,843,431	13,028,673
53	12,502,197	12,670,055	12,846,443	13,031,839
54	12,504,927	12,672,924	12,849,458	13,035,008
55	12,507,659	12,675,795	12,852,475	13,038,180
56	12,510,394	12,678,668	12,855,495	13,041,354
57	12,513,132	12,681,543	12,858,517	13,044,530
58	12,515,871	12,684,421	12,861,542	13,047,710
59	12,518,613	12,687,301	12,864,569	13,050,892
60	12,521,357	12,690,184	12,867,599	13,054,077

H 2

	40	41	42	43
0	13,054,077	13,250,131	13,456,326	13,673,275
1	13,057,264	13,253,482	13,459,851	13,676,986
2	13,060,455	13,256,835	13,463,380	13,680,700
3	13,063,646	13,260,192	13,466,912	13,684,417
4	13,066,843	13,263,582	13,470,447	13,688,138
5	13,070,041	13,266,915	13,473,985	13,691,861
6	13,073,242	13,270,282	13,477,527	13,695,587
7	13,076,445	13,273,651	13,481,071	13,699,316
8	13,079,651	13,277,023	13,484,618	13,703,048
9	13,082,859	13,280,397	13,488,168	13,706,783
10	13,086,071	13,283,775	13,491,721	13,710,523
11	13,089,285	13,287,155	13,495,276	13,714,266
12	13,092,502	13,290,538	13,498,835	13,718,012
13	13,095,721	13,293,924	13,502,397	13,721,761
14	13,098,944	13,297,313	13,505,962	13,725,514
15	13,102,169	13,300,704	13,509,530	13,729,270
16	13,105,397	13,304,098	13,513,101	13,733,029
17	13,108,627	13,307,495	13,516,675	13,736,790
18	13,111,861	13,310,896	13,520,252	13,740,555
19	13,114,098	13,314,299	13,523,832	13,744,322
20	13,118,337	13,317,705	13,527,416	13,748,092
21	13,121,578	13,321,114	13,531,003	13,751,867
22	13,124,823	13,324,526	13,534,593	13,755,644
23	13,128,070	13,327,941	13,538,185	13,759,424
24	13,131,320	13,331,359	13,541,781	13,763,209
25	13,134,572	13,334,779	13,545,380	13,766,997
26	13,137,828	13,338,203	13,548,981	13,770,788
27	13,141,085	13,341,629	13,552,585	13,774,582
28	13,144,346	13,345,058	13,556,193	13,778,380
29	13,147,509	13,348,490	13,559,803	13,782,181
30	13,150,874	13,351,924	13,563,417	13,785,985

	40	41	42	43
30	13,150,874	13,351,924	13,563,417	13,785,985
31	13,154,142	13,355,361	13,567,034	13,789,792
32	13,157,413	13,358,802	13,570,654	13,793,603
33	13,160,687	13,362,245	13,574,277	13,797,416
34	13,163,964	13,365,691	13,577,903	13,801,233
35	13,167,243	13,369,140	13,581,532	13,805,053
36	13,170,526	13,372,592	13,585,164	13,808,876
37	13,173,811	13,376,057	13,588,799	13,812,703
38	13,177,099	13,379,505	13,592,438	13,816,534
39	13,180,389	13,382,966	13,596,079	13,820,368
40	13,183,682	13,386,430	13,599,723	13,824,205
41	13,186,978	13,389,897	13,603,370	13,828,045
42	13,190,276	13,393,367	13,607,021	13,831,889
43	13,193,577	13,396,839	13,610,675	13,835,736
44	13,196,882	13,400,315	13,614,332	13,839,586
45	13,200,189	13,403,794	13,617,992	13,843,439
46	13,203,499	13,407,275	13,621,656	13,847,296
47	13,206,812	13,410,759	13,625,323	13,851,156
48	13,210,128	13,414,247	13,628,993	13,855,019
49	13,213,447	13,417,738	13,632,666	13,858,885
50	13,216,769	13,421,232	13,636,342	13,862,755
51	13,220,093	13,424,728	13,640,021	13,866,628
52	13,223,421	13,428,227	13,643,704	13,870,505
53	13,226,750	13,431,729	13,647,390	13,874,385
54	13,230,082	13,435,234	13,651,078	13,878,268
55	13,233,417	13,438,742	13,654,769	13,882,154
56	13,236,754	13,442,253	13,658,464	13,886,044
57	13,240,094	13,445,767	13,662,162	13,889,936
58	13,243,437	13,449,284	13,665,863	13,893,833
59	13,246,783	13,452,804	13,669,567	13,897,733
60	13,250,131	13,456,326	13,673,275	13,901,636

H 3

	44	45	46	47
0	13,901,636	14,142,135	14,395,564	14,662,790
1	13,905,542	14,146,251	14,399,901	14,667,366
2	13,909,452	14,150,371	14,404,242	14,671,946
3	13,913,365	14,154,494	14,408,587	14,676,530
4	13,917,281	14,158,621	14,412,937	14,681,119
5	13,921,201	14,162,751	14,417,290	14,685,712
6	13,925,126	14,166,884	14,421,647	14,690,309
7	13,929,052	14,171,021	14,426,008	14,694,910
8	13,922,982	14,175,162	14,430,374	14,699,514
9	13,936,916	14,179,306	14,434,743	14,704,122
10	13,940,854	14,183,454	14,439,116	14,708,735
11	13,944,795	14,187,606	14,443,493	14,713,352
12	13,948,739	14,191,761	14,447,874	14,717,973
13	13,952,686	14,195,919	14,452,259	14,722,598
14	13,956,638	14,200,082	14,456,648	14,727,228
15	13,960,592	14,204,248	14,461,040	14,731,862
16	13,964,550	14,208,418	14,465,437	14,736,500
17	13,968,511	14,212,591	14,469,838	14,741,142
18	13,972,476	14,216,769	14,474,242	14,745,788
19	13,976,444	14,220,950	14,478,650	14,750,438
20	13,980,416	14,225,135	14,483,062	14,755,094
21	13,984,391	14,229,324	14,487,478	14,759,753
22	13,988,370	14,233,517	14,491,898	14,764,416
23	13,992,352	14,237,713	14,496,322	14,769,083
24	13,996,338	14,241,912	14,500,750	14,773,755
25	14,000,327	14,246,115	14,505,182	14,778,430
26	14,004,319	14,250,321	14,509,617	14,783,110
27	14,008,315	14,254,531	14,514,056	14,787,794
28	14,012,314	14,258,745	14,518,500	14,792,482
29	14,016,316	14,262,961	14,522,946	14,797,174
30	14,020,322	14,267,182	14,527,397	14,801,871

	44	45	46	47
30	14,020,322	14,267,182	14,527,397	14,801,871
31	14,024,332	14,271,407	14,531,852	14,806,571
32	14,028,345	14,275,635	14,536,311	14,811,276
33	14,032,361	14,279,867	14,540,773	14,815,985
34	14,036,381	14,284,103	14,545,240	14,820,698
35	14,040,404	14,288,343	14,549,711	14,825,416
36	14,044,431	14,292,587	14,554,186	14,830,139
37	14,048,461	14,296,834	14,558,665	14,834,866
38	14,052,494	14,301,086	14,563,148	14,839,597
39	14,056,531	14,305,331	14,567,635	14,844,332
40	14,060,572	14,309,599	14,572,126	14,849,072
41	14,064,616	14,313,861	14,576,621	14,853,815
42	14,068,664	14,318,127	14,581,120	14,858,563
43	14,072,715	14,322,396	14,585,624	14,863,315
44	14,076,770	14,326,670	14,590,131	14,868,071
45	14,080,829	14,330,947	14,594,642	14,872,831
46	14,084,891	14,335,228	14,599,157	14,877,597
47	14,088,956	14,339,513	14,603,676	14,882,377
48	14,093,026	14,343,802	14,608,199	14,887,141
49	14,097,099	14,348,095	14,612,725	14,891,919
50	14,101,175	14,352,391	14,617,256	14,896,701
51	14,105,255	14,356,691	14,621,791	14,901,487
52	14,109,339	14,360,995	14,626,330	14,906,278
53	14,113,427	14,365,303	14,630,873	14,911,073
54	14,117,518	14,369,615	14,635,421	14,915,873
55	14,121,612	14,373,930	14,639,973	14,920,677
56	14,125,709	14,378,350	14,644,528	14,925,486
57	14,129,810	14,382,573	14,649,087	14,930,299
58	14,133,915	14,386,900	14,653,651	14,935,116
59	14,138,023	14,391,230	14,658,218	14,939,938
60	14,142,135	14,395,564	14,662,790	14,944,764

	48	49	50	51
0	14,944,764	15,242,532	15,557,239	15,890,158
1	14,949,594	15,247,634	15,562,635	15,895,869
2	14,954,429	15,252,741	15,568,036	15,901,586
3	14,959,268	15,257,852	15,573,441	15,907,307
4	14,964,112	15,262,969	15,578,852	15,913,034
5	14,968,960	15,268,990	15,584,267	15,918,766
6	14,973,812	15,273,216	15,589,688	15,924,504
7	14,978,668	15,278,347	15,595,114	15,930,247
8	14,983,530	15,283,484	15,600,545	15,936,095
9	14,988,396	15,288,626	15,605,981	15,941,748
10	14,993,266	15,293,773	15,611,422	15,947,508
11	14,998,104	15,298,924	15,616,868	15,953,273
12	15,003,020	15,304,080	15,622,319	15,959,044
13	15,007,903	15,309,240	15,627,775	15,964,820
14	15,012,791	15,314,405	15,633,237	15,970,603
15	15,017,683	15,319,574	15,639,704	15,976,390
16	15,022,580	15,324,748	15,644,177	15,982,184
17	15,027,481	15,329,926	15,649,655	15,987,983
18	15,032,387	15,335,109	15,655,138	15,993,788
19	15,037,297	15,340,297	15,660,626	15,999,599
20	15,042,212	15,345,491	15,666,119	16,005,416
21	15,047,131	15,350,689	15,671,617	16,011,237
22	15,052,054	15,355,892	15,677,121	16,017,065
23	15,056,982	15,361,100	15,682,630	16,022,898
24	15,061,915	15,366,313	15,688,144	16,028,736
25	15,066,852	15,371,530	15,693,663	16,034,579
26	15,071,791	15,376,753	15,699,188	16,040,429
27	15,076,739	15,381,980	15,704,717	16,046,283
28	15,081,690	15,387,212	15,710,252	16,052,143
29	15,086,645	15,392,449	15,715,792	16,058,008
30	15,091,605	15,397,692	15,721,337	16,063,878

	48	49	50	51
30	15,091,605	15,397,692	15,721,337	16,063,878
31	15,096,569	15,402,939	15,726,887	16,069,754
32	15,101,538	15,408,191	15,732,443	16,075,637
33	15,106,571	15,413,447	15,738,003	16,081,524
34	15,111,490	15,418,708	15,743,569	16,087,418
35	15,116,472	15,423,974	15,749,141	16,093,318
36	15,121,459	15,429,246	15,754,718	16,099,224
37	15,126,451	15,434,522	15,760,300	16,105,135
38	15,131,447	15,439,803	15,765,887	16,111,053
39	15,136,447	15,445,089	15,771,479	16,116,976
40	15,141,453	15,450,380	15,777,077	16,122,905
41	15,146,463	15,455,675	15,782,680	16,128,839
42	15,151,478	15,460,976	15,788,289	16,134,779
43	15,156,497	15,466,282	15,793,903	16,140,724
44	15,161,520	15,471,593	15,799,523	16,146,676
45	15,166,548	15,476,908	15,805,147	16,152,634
46	15,171,581	15,482,229	15,810,777	16,158,598
47	15,176,619	15,487,554	15,816,412	16,164,567
48	15,181,661	15,492,885	15,822,052	16,170,542
49	15,186,708	15,498,220	15,827,697	16,176,522
50	15,191,760	15,503,560	15,833,349	16,182,509
51	15,196,816	15,508,905	15,839,005	16,188,501
52	15,201,877	15,514,256	15,844,667	16,194,499
53	15,206,943	15,519,611	15,850,335	16,200,503
54	15,212,013	15,524,972	15,856,008	16,206,513
55	15,217,088	15,530,338	15,861,676	16,212,528
56	15,222,168	15,535,710	15,867,370	16,218,550
57	15,227,253	15,541,083	15,873,058	16,224,577
58	15,232,342	15,546,463	15,878,753	16,230,610
59	15,237,435	15,551,848	15,884,453	16,236,648
60	15,242,532	15,557,239	15,890,158	16,242,692

	52	53	54	55
0	16,242,692	16,616,401	17,013,017	17,434,469
1	16,248,742	16,622,819	17,019,832	17,441,715
2	16,254,799	16,629,243	17,026,654	17,448,968
3	16,260,861	16,635,673	17,033,482	17,456,229
4	16,266,929	16,642,109	17,040,318	17,463,499
5	16,273,003	16,648,551	17,047,160	17,470,775
6	16,279,083	16,655,001	17,054,010	17,478,059
7	16,285,169	16,661,457	17,060,866	17,485,351
8	16,291,261	16,667,919	17,067,729	17,492,650
9	16,297,358	16,674,408	17,074,599	17,499,957
10	16,303,461	16,680,864	17,081,476	17,507,272
11	16,309,570	16,687,345	17,088,359	17,514,594
12	16,315,685	16,693,834	17,095,250	17,521,924
13	16,321,806	16,700,328	17,102,148	17,529,262
14	16,327,934	16,706,829	17,109,053	17,536,607
15	16,334,067	16,713,336	17,115,965	17,543,959
16	16,340,197	16,719,850	17,122,885	17,551,319
17	16,346,353	16,726,362	17,129,812	17,558,687
18	16,352,505	16,732,877	17,136,747	17,566,063
19	16,358,663	16,739,430	17,143,689	17,573,446
20	16,364,827	16,745,970	17,150,638	17,580,837
21	16,370,996	16,752,517	17,157,593	17,588,236
22	16,377,172	16,759,070	17,164,556	17,595,643
23	16,383,359	16,765,629	17,171,525	17,603,057
24	16,389,542	16,772,195	17,178,502	17,610,480
25	16,395,736	16,778,767	17,185,485	17,617,909
26	16,401,936	16,785,347	17,192,476	17,625,347
27	16,408,152	16,791,933	17,199,472	17,632,793
28	16,414,365	16,798,525	17,206,477	17,640,246
29	16,420,573	16,805,124	17,213,488	17,647,707
30	16,426,798	16,811,729	17,220,507	17,655,175

	52	53	54	55
30	16,426,798	16,811,729	17,220,507	17,655,175
31	16,433,027	16,818,341	17,227,532	17,662,651
32	16,439,263	16,824,960	17,234,565	17,670,136
33	16,445,505	16,831,585	17,241,605	17,677,627
34	16,451,754	16,838,217	17,248,653	17,685,127
35	16,458,008	16,844,856	17,255,708	17,692,635
36	16,464,269	16,851,502	17,262,770	17,700,151
37	16,470,536	16,858,154	17,269,839	17,707,674
38	16,476,809	16,864,813	17,276,917	17,715,206
39	16,483,089	16,871,479	17,284,002	17,722,744
40	16,489,385	16,878,151	17,291,095	17,730,290
41	16,495,668	16,884,830	17,298,194	17,737,844
42	16,501,967	16,891,515	17,305,300	17,745,407
43	16,508,272	16,898,207	17,312,413	17,752,978
44	16,514,582	16,904,907	17,319,534	17,760,555
45	16,520,898	16,911,613	17,326,662	17,768,142
46	16,527,220	16,918,326	17,333,798	17,775,740
47	16,533,548	16,925,046	17,340,941	17,783,343
48	16,539,883	16,931,772	17,348,091	17,790,955
49	16,546,224	16,938,504	17,355,249	17,798,575
50	16,552,571	16,945,244	17,362,415	17,806,203
51	16,558,925	16,951,990	17,369,587	17,813,838
52	16,565,286	16,958,743	17,376,767	17,821,481
53	16,571,642	16,965,495	17,383,954	17,829,132
54	16,578,026	16,972,270	17,391,148	17,836,792
55	16,584,406	16,979,044	17,398,350	17,844,460
56	16,590,792	16,985,824	17,405,560	17,852,135
57	16,597,184	16,992,611	17,412,776	17,859,818
58	16,603,584	16,999,406	17,420,000	17,867,509
59	16,609,989	17,006,208	17,427,231	17,875,209
60	16,616,401	17,013,017	17,434,469	17,882,917

	56	57	58	59
0	17,882,917	18,360,816	18,870,800	19,416,039
1	17,890,632	18,369,014	18,879,589	19,425,445
2	17,898,356	18,377,251	18,888,389	19,434,862
3	17,906,089	18,385,497	18,897,196	19,444,290
4	17,913,830	18,393,753	18,906,018	19,453,727
5	17,921,579	18,402,017	18,914,846	19,463,175
6	17,929,337	18,410,291	18,923,685	19,472,635
7	17,937,102	18,418,574	18,932,534	19,482,114
8	17,944,876	18,426,865	18,941,393	19,491,595
9	17,952,658	18,435,165	18,950,261	19,501,076
10	17,960,448	18,443,454	18,959,139	19,510,578
11	17,968,247	18,451,792	18,968,027	19,520,091
12	17,976,054	18,460,120	18,976,926	19,529,615
13	17,983,869	18,468,456	18,985,834	19,539,150
14	17,991,693	18,476,802	18,994,752	19,548,697
15	17,999,525	18,485,157	19,003,680	19,558,254
16	18,007,365	18,493,521	19,012,618	19,567,822
17	18,015,214	18,501,895	19,021,516	19,577,401
18	18,023,071	18,510,278	19,030,523	19,586,991
19	18,030,936	18,518,670	19,039,491	19,596,592
20	18,038,811	18,527,072	19,048,468	19,606,204
21	18,046,693	18,535,483	19,057,455	19,615,827
22	18,054,584	18,543,903	19,066,453	19,625,462
23	18,062,482	18,552,332	19,075,461	19,635,107
24	18,070,389	18,560,770	19,084,480	19,644,765
25	18,078,305	18,569,217	19,093,509	19,654,434
26	18,086,229	18,577,674	19,102,549	19,664,114
27	18,094,161	18,586,139	19,111,598	19,673,805
28	18,102,102	18,594,614	19,120,658	19,683,507
29	18,110,051	18,603,098	19,129,727	19,693,220
30	18,118,009	18,611,591	19,138,807	19,702,945

	56	57	58	59
30	18,118,009	18,611,591	19,138,807	19,702,945
31	18,125,975	18,620,094	19,147,897	19,712,680
32	18,133,950	18,628,606	19,156,998	19,722,428
33	18,141,934	18,637,127	19,166,109	19,732,186
34	18,149,926	18,645,659	19,175,231	19,741,956
35	18,157,927	18,654,198	19,184,362	19,751,738
36	18,165,937	18,662,748	19,193,504	19,761,531
37	18,173,956	18,671,307	19,202,656	19,771,335
38	18,181,984	18,679,875	19,211,818	19,781,141
39	18,190,021	18,688,452	19,220,990	19,790,968
40	18,198,065	18,697,038	19,230,172	19,800,808
41	18,206,118	18,705,634	19,239,365	19,810,658
42	18,214,179	18,714,239	19,248,569	19,820,520
43	18,222,249	18,722,854	19,257,783	19,830,393
44	18,230,328	18,731,480	19,267,008	19,840,277
45	18,238,416	18,740,115	19,276,242	19,850,172
46	18,246,513	18,748,760	19,285,486	19,860,079
47	18,254,618	18,757,414	19,294,744	19,869,997
48	18,262,732	18,766,078	19,304,010	19,879,927
49	18,270,854	18,774,752	19,313,287	19,889,868
50	18,278,986	18,783,436	19,322,574	19,899,820
51	18,287,126	18,792,130	19,331,872	19,909,784
52	18,295,276	18,800,833	19,341,181	19,919,760
53	18,303,434	18,809,546	19,350,501	19,929,748
54	18,311,601	18,818,268	19,359,831	19,939,749
55	18,319,776	18,826,999	19,369,172	19,949,760
56	18,327,961	18,835,741	19,378,524	19,959,784
57	18,336,154	18,844,492	19,387,886	19,969,820
58	18,344,356	18,853,252	19,397,260	19,979,868
59	18,352,567	18,862,021	19,406,644	19,989,928
60	18,360,816	18,870,800	19,416,039	20,000,000

	60	61	62	63
0	20,000,000	20,626,654	21,300,545	22,026,892
1	20,010,083	20,637,484	21,312,206	22,039,475
2	20,020,179	20,648,338	21,323,882	22,052,074
3	20,030,285	20,659,184	21,335,570	22,064,690
4	20,040,404	20,670,054	21,347,275	22,077,322
5	20,050,534	20,680,937	21,358,993	22,089,970
6	20,060,676	20,691,834	21,370,727	22,102,635
7	20,070,832	20,702,744	21,382,475	22,115,316
8	20,080,995	20,713,667	21,394,238	22,128,014
9	20,091,172	20,724,603	21,407,016	22,140,727
10	20,101,361	20,735,554	21,417,808	22,153,459
11	20,111,562	20,746,517	21,429,615	22,166,204
12	20,121,776	20,757,494	21,441,438	22,178,971
13	20,132,001	20,768,484	21,453,275	22,191,751
14	20,142,239	20,779,488	21,465,128	22,204,548
15	20,152,489	20,790,505	21,476,995	22,217,361
16	20,162,751	20,801,535	21,488,877	22,230,191
17	20,173,035	20,812,579	21,500,774	22,243,038
18	20,183,321	20,823,636	21,512,686	22,255,902
19	20,193,619	20,834,706	21,524,612	22,268,782
20	20,203,930	20,845,791	21,536,553	22,281,680
21	20,214,252	20,856,888	21,548,509	22,294,595
22	20,224,588	20,868,000	21,560,481	22,307,526
23	20,234,936	20,879,125	21,572,467	22,320,474
24	20,245,296	20,890,264	21,584,469	22,333,439
25	20,255,669	20,901,416	21,596,487	22,346,420
26	20,266,054	20,912,582	21,608,520	22,359,419
27	20,276,452	20,923,761	21,620,568	22,372,434
28	20,286,863	20,934,955	21,632,631	22,385,466
29	20,297,286	20,946,162	21,644,710	22,398,418
30	20,307,721	20,957,383	21,656,804	22,411,584

SECANTIV M.

255

	60	61	62	63
30	20,307,721	20,957,383	21,656,804	22,411,584
31	20,318,170	20,968,618	21,668,913	22,424,667
32	20,328,630	20,979,867	21,681,038	22,437,768
33	20,339,102	20,991,130	21,693,178	22,450,886
34	20,349,587	21,002,406	21,705,334	22,464,022
35	20,360,084	21,013,696	21,717,505	22,477,175
36	20,370,594	21,025,001	21,729,691	22,490,346
37	20,381,116	21,036,319	21,741,893	22,503,543
38	20,391,751	21,047,651	21,754,111	22,516,748
39	20,402,198	21,058,997	21,766,344	22,529,965
40	20,412,758	21,070,357	21,778,593	22,543,201
41	20,423,331	21,081,731	21,770,858	22,556,358
42	20,433,916	21,093,119	21,803,138	22,569,723
43	20,444,514	21,104,522	21,815,434	22,583,025
44	20,455,126	21,115,938	21,827,745	22,596,336
45	20,465,750	21,127,368	21,840,072	22,609,663
46	20,476,387	21,138,814	21,852,415	22,623,009
47	20,487,037	21,150,273	21,864,774	22,636,372
48	20,497,700	21,161,747	21,877,149	22,650,753
49	20,508,376	21,173,235	21,889,539	22,663,152
50	20,519,064	21,184,737	21,901,946	22,676,569
51	20,529,765	21,196,253	21,914,369	22,690,004
52	20,540,479	21,207,783	21,926,808	22,703,456
53	20,551,205	21,219,328	21,939,263	22,716,924
54	20,561,945	21,230,887	21,951,734	22,730,414
55	20,572,697	21,242,460	21,964,220	22,743,919
56	20,583,463	21,254,048	21,976,722	22,757,443
57	20,594,242	21,265,650	21,989,240	22,770,984
58	20,605,033	21,277,267	22,001,775	22,784,543
59	20,615,837	21,288,899	22,014,325	22,798,120
60	20,626,654	21,300,545	22,026,892	22,811,726

	64	65	66	67
0	22,811,726	23,662,013	24,585,936	25,593,051
1	22,825,329	23,676,784	24,602,010	25,610,602
2	22,838,962	23,691,575	24,618,107	25,628,180
3	22,852,612	23,706,387	24,634,227	25,645,783
4	22,866,281	23,721,220	24,650,370	25,663,414
5	22,879,968	23,736,073	24,666,536	25,681,071
6	22,893,674	23,750,947	24,682,727	25,698,754
7	22,907,387	23,765,842	24,698,940	25,716,464
8	22,921,140	23,780,757	24,715,178	25,734,201
9	22,934,901	23,795,692	24,731,439	25,751,965
10	22,948,680	23,810,648	24,747,724	25,769,755
11	22,962,478	23,825,625	24,764,033	25,787,582
12	22,976,294	23,840,623	24,780,365	25,805,417
13	22,990,129	23,855,642	24,796,721	25,823,287
14	23,003,983	23,870,683	24,813,101	25,841,185
15	23,017,855	23,885,844	24,829,504	25,859,104
16	23,031,747	23,900,827	24,845,932	25,877,061
17	23,045,657	23,915,931	24,862,383	25,895,040
18	23,059,586	23,931,055	24,878,858	25,913,046
19	23,073,534	23,946,200	24,895,356	25,931,080
20	23,087,501	23,961,366	24,911,878	25,949,142
21	23,101,486	23,976,553	24,928,423	25,967,230
22	23,115,490	23,991,762	24,944,993	25,985,345
23	23,129,513	24,006,992	24,961,587	26,003,487
24	23,143,556	24,022,245	24,978,205	26,021,658
25	23,157,616	24,037,518	24,994,847	26,039,855
26	23,171,696	24,052,814	25,011,514	26,058,081
27	23,185,795	24,068,130	25,028,205	26,076,333
28	23,199,913	24,083,469	25,044,920	26,094,614
29	23,214,050	24,098,830	25,061,660	26,112,923
30	23,228,205	24,114,213	25,078,426	26,131,259

	64	65	66	67
30	23,228,205	24,114,213	25,078,426	26,131,259
31	23,242,380	24,129,616	25,095,216	26,149,623
32	23,256,574	24,145,041	25,112,030	26,168,015
33	23,270,797	24,160,487	25,128,869	26,186,436
34	23,285,021	24,175,956	25,145,732	26,204,884
35	23,299,273	24,191,445	25,162,620	26,223,361
36	23,313,546	24,206,956	25,179,532	26,241,867
37	23,327,838	24,222,488	25,196,469	26,260,400
38	23,342,150	24,238,043	25,213,432	26,278,963
39	23,356,481	24,253,619	25,230,418	26,297,555
40	23,370,832	24,269,217	25,247,431	26,316,176
41	23,385,203	24,284,838	25,264,468	26,334,825
42	23,399,593	24,300,481	25,281,531	26,353,503
43	23,414,003	24,316,147	25,298,620	26,372,209
44	23,428,433	24,331,835	25,315,734	26,390,945
45	23,442,882	24,347,546	25,332,874	26,409,709
46	23,457,351	24,363,281	25,350,039	26,428,502
47	23,471,840	24,379,038	25,367,229	26,447,323
48	23,486,348	24,394,818	25,384,445	26,466,174
49	23,500,876	24,410,620	25,401,687	26,485,053
50	23,515,424	24,426,446	25,418,956	26,503,962
51	23,529,992	24,442,294	25,436,250	26,522,890
52	23,544,580	24,458,164	25,453,570	26,541,867
53	23,559,188	24,474,056	25,470,915	26,560,863
54	23,573,817	24,489,973	25,488,286	26,579,889
55	23,588,565	24,505,908	25,505,683	26,598,945
56	23,603,134	24,521,869	25,523,005	26,618,030
57	23,617,822	24,537,851	25,540,553	26,637,145
58	23,632,532	24,553,857	25,558,027	26,656,291
59	23,647,262	24,569,885	25,575,526	26,675,466
60	23,662,013	24,585,936	25,593,051	26,694,672

K

	68	69	70	71
0	26,694,672	27,904,284	29,238,045	30,715,531
1	26,713,907	27,925,445	29,261,433	30,741,500
2	26,733,172	27,946,642	29,284,861	30,767,516
3	26,752,467	27,967,873	29,308,328	30,793,579
4	26,771,791	27,989,139	29,331,835	30,819,689
5	26,791,145	28,010,440	29,355,382	30,845,846
6	26,810,529	28,031,776	29,378,970	30,872,051
7	26,829,942	28,053,147	29,402,599	30,898,304
8	26,849,390	28,074,553	29,426,268	30,924,605
9	26,868,867	28,095,994	29,449,978	30,950,953
10	26,888,373	28,117,469	29,473,728	30,977,350
11	26,907,910	28,138,980	29,497,519	31,003,793
12	26,927,479	28,160,527	29,521,350	31,030,285
13	26,947,078	28,182,108	29,545,222	31,056,824
14	26,966,709	28,203,725	29,569,136	31,083,412
15	26,986,370	28,225,378	29,593,090	31,110,047
16	27,006,062	28,247,067	29,617,087	31,136,731
17	27,025,785	28,268,793	29,641,124	31,163,462
18	27,045,539	28,290,553	29,665,204	31,190,241
19	27,065,323	28,312,349	29,689,326	31,217,019
20	27,085,138	28,334,181	29,713,488	31,243,945
21	27,104,985	28,356,049	29,737,692	31,270,871
22	27,124,864	28,377,954	29,761,938	31,297,848
23	27,144,774	28,399,894	29,786,227	31,324,873
24	27,164,717	28,421,871	29,810,558	31,351,948
25	27,184,690	28,443,884	29,834,931	31,379,072
26	27,204,686	28,465,934	29,859,347	31,406,247
27	27,224,734	28,488,021	29,883,705	31,433,472
28	27,244,804	28,510,144	29,908,306	31,460,747
29	27,264,906	28,532,304	29,932,850	31,488,072
30	27,285,040	28,554,501	29,957,438	31,515,448

SECANTIV M.

358

	68	69	70	71
30	27,285,040	28,544,501	29,957,438	31,515,448
31	27,305,205	28,576,735	29,982,069	31,542,873
32	27,325,402	28,599,007	30,006,743	31,570,349
33	27,345,631	28,621,316	30,031,460	31,597,875
34	27,365,893	28,643,662	30,056,220	31,625,453
35	27,386,286	28,666,045	30,081,023	31,653,080
36	27,406,513	28,688,467	30,105,870	31,680,758
37	27,426,872	28,710,925	30,130,760	31,708,486
38	27,447,264	28,733,422	30,155,714	31,736,265
39	27,467,688	28,755,956	30,180,672	31,764,094
40	27,488,145	28,778,549	30,205,694	31,791,974
41	27,508,635	28,801,139	30,230,760	31,819,906
42	27,529,157	28,823,787	30,255,871	31,847,891
43	27,549,722	28,846,473	30,281,026	31,875,929
44	27,570,301	28,869,196	30,306,226	31,904,019
45	27,590,922	28,891,957	30,331,460	31,932,164
46	27,611,578	28,914,756	30,356,759	31,960,358
47	27,632,266	28,937,594	30,382,092	31,988,606
48	27,652,989	28,960,471	30,407,470	32,016,909
49	27,673,745	28,983,386	30,432,893	32,045,263
50	27,694,535	29,006,340	30,458,361	32,073,672
51	27,715,358	29,029,332	30,483,873	32,102,132
52	27,736,215	29,052,363	30,509,430	32,130,646
53	27,757,105	29,075,435	30,535,033	32,159,212
54	27,778,029	29,098,546	30,560,682	32,187,832
55	27,798,987	29,121,697	30,586,375	32,216,504
56	27,819,978	29,144,888	30,617,115	32,245,231
57	27,841,003	29,168,118	30,637,890	32,274,012
58	27,862,060	29,191,388	30,663,732	32,302,846
59	27,883,156	29,214,697	30,689,608	32,331,735
60	27,904,284	29,238,045	30,715,531	32,360,678

K 2

	72	73	74	75
0	32,360,678	34,203,038	36,279,559	38,637,042
1	32,389,676	34,235,609	36,316,402	38,679,033
2	32,418,726	34,268,245	36,353,333	38,721,117
3	32,447,837	34,300,947	36,390,323	38,763,296
4	32,477,001	34,333,716	36,427,401	38,805,571
5	32,506,219	34,366,553	36,464,558	38,847,941
6	32,535,494	34,399,452	36,501,793	38,890,408
7	32,564,823	34,432,420	36,539,107	38,932,971
8	32,594,209	34,465,456	36,576,511	38,975,632
9	32,623,651	34,498,557	36,613,973	38,018,390
10	32,653,148	34,531,726	36,651,525	39,061,246
11	32,682,701	34,564,959	36,689,156	39,104,200
12	32,712,311	34,598,259	36,726,868	39,147,252
13	32,741,977	34,631,626	36,864,660	39,190,423
14	32,771,699	34,665,061	36,702,533	39,233,653
15	32,801,478	34,698,564	36,840,488	39,277,002
16	32,831,314	34,732,135	36,878,524	39,320,449
17	32,861,207	34,765,775	36,916,641	39,363,994
18	32,891,157	34,799,483	36,954,842	39,407,640
19	32,921,165	34,833,259	36,993,127	39,451,384
20	32,951,231	34,867,105	37,031,496	39,495,228
21	32,981,355	34,901,024	37,069,947	39,539,172
22	33,011,537	34,935,005	37,108,482	39,583,218
23	33,041,776	34,969,052	37,147,101	39,627,364
24	33,072,074	35,003,172	37,185,803	39,671,613
25	33,102,431	35,037,361	37,224,589	39,715,965
26	33,132,846	35,071,621	37,263,459	39,760,420
27	33,163,320	35,105,952	37,302,413	39,704,979
28	33,193,853	35,140,354	37,341,453	39,849,642
29	33,224,444	35,174,826	37,380,577	39,894,411
30	33,255,094	35,209,369	37,419,788	39,939,286

	72	73	74	75
30	33,255,094	35,209,369	37,419,788	39,939,286
31	33,285,803	35,243,981	37,459,081	39,984,263
32	33,316,571	35,278,664	37,498,460	40,029,344
33	33,347,398	35,313,418	37,537,923	40,074,528
34	33,378,286	35,348,244	37,577,471	40,119,816
35	33,409,232	35,383,140	37,617,104	40,165,209
36	33,440,240	35,418,110	37,656,824	40,210,709
37	33,471,307	35,453,152	37,696,632	40,256,316
38	33,502,436	35,488,268	37,736,518	40,302,033
39	33,533,625	35,523,456	37,776,513	40,347,858
40	33,564,875	35,558,718	37,816,588	40,393,792
41	33,596,187	35,594,052	37,856,751	40,439,834
42	33,627,561	35,629,460	37,897,004	40,485,985
43	33,658,998	35,664,940	37,937,146	40,532,245
44	33,690,497	35,700,494	37,977,779	40,578,613
45	33,722,059	35,736,121	38,018,300	40,625,091
46	33,753,683	35,771,822	38,058,912	40,671,678
47	33,785,370	35,807,597	38,099,614	40,718,374
48	33,817,120	35,843,447	38,140,406	40,765,180
49	33,848,934	35,879,373	38,181,288	40,812,093
50	33,880,813	35,915,374	38,222,261	40,859,121
51	33,912,753	35,951,451	38,263,324	40,906,259
52	33,944,756	35,987,602	38,304,479	40,953,510
53	33,976,821	36,023,829	38,345,725	41,000,876
54	34,008,950	36,060,132	38,387,064	41,048,358
55	34,041,141	36,096,510	38,428,495	41,095,957
56	34,073,395	36,132,966	38,470,019	41,143,668
57	34,105,712	36,169,497	38,511,635	41,191,492
58	34,138,091	36,206,107	38,553,344	41,239,431
59	34,170,523	36,242,794	38,595,146	41,287,425
60	34,203,038	36,279,559	38,637,042	41,335,654

K 3

	76	77	78	79
0	41,335,554	44,454,097	48,097,335	52,408,433
1	41,383,937	44,510,183	48,103,251	52,486,983
2	41,432,338	44,566,415	48,229,350	52,565,774
3	41,480,856	44,622,793	48,295,633	52,644,807
4	41,529,492	44,679,318	48,362,102	52,724,084
5	41,578,245	44,735,990	48,428,756	52,803,604
6	41,627,117	44,792,810	48,495,599	52,883,368
7	41,676,108	44,849,777	48,562,631	52,963,377
8	41,725,219	44,906,892	48,629,854	53,043,632
9	41,774,450	44,964,155	48,697,269	53,124,134
10	41,823,802	45,021,567	48,764,877	53,204,885
11	41,873,273	45,079,129	48,832,678	53,285,884
12	41,922,863	45,136,843	48,900,673	53,367,134
13	41,972,573	45,194,707	48,968,853	53,448,635
14	42,022,405	45,252,726	49,037,249	53,530,390
15	42,072,357	45,310,898	49,105,830	53,612,399
16	42,122,431	45,369,224	49,174,607	53,694,666
17	42,172,625	45,427,703	49,243,590	53,777,191
18	42,222,942	45,486,338	49,312,751	53,859,976
19	42,273,380	45,545,127	49,382,118	53,943,022
20	42,323,942	45,604,073	49,451,684	54,026,331
21	42,374,627	45,663,175	49,521,449	54,109,903
22	42,425,439	45,722,435	49,591,416	54,193,739
23	42,476,377	45,781,853	49,661,584	54,277,840
24	42,527,442	45,841,429	49,731,956	54,362,207
25	42,578,635	45,901,164	49,802,532	54,446,842
26	42,629,957	45,961,059	49,873,313	54,531,744
27	42,681,409	46,021,115	49,944,301	54,616,915
28	42,732,991	46,081,333	50,015,497	54,702,356
29	42,784,705	46,141,715	50,086,901	54,788,068
30	42,836,551	46,202,261	50,158,514	54,874,053

	76	77	78	79
30	42,836,551	46,202,261	50,158,514	54,874,053
31	42,888,527	46,262,969	50,230,335	54,960,312
32	42,940,631	46,323,841	50,302,367	55,046,847
33	42,992,865	46,384,877	50,374,610	55,133,659
34	43,045,229	46,446,076	50,447,065	55,220,751
35	43,097,722	46,507,440	50,519,732	55,308,122
36	43,150,347	46,568,970	50,592,614	55,395,275
37	43,203,103	46,630,665	50,665,711	55,483,710
38	43,255,992	46,692,527	50,739,024	55,571,930
39	43,309,012	46,754,555	50,812,553	55,660,434
40	43,362,166	46,816,752	50,886,299	55,749,226
41	43,415,454	46,879,117	50,960,263	55,838,300
42	43,468,877	46,941,653	51,034,447	55,927,677
43	43,522,435	47,004,361	51,108,850	56,017,340
44	43,576,129	47,067,242	51,183,475	56,107,297
45	43,629,959	47,130,297	51,258,321	56,197,549
46	43,683,925	47,193,526	51,333,391	56,288,099
47	43,738,028	47,256,930	51,408,684	56,378,948
48	43,792,268	47,320,509	51,484,204	56,470,097
49	43,846,646	47,384,264	51,559,951	56,561,548
50	43,901,162	47,448,195	51,635,936	56,653,302
51	43,955,817	47,512,302	51,712,129	56,745,360
52	44,000,612	47,576,586	51,788,563	56,837,723
53	44,065,548	47,641,048	51,865,227	56,930,392
54	44,120,625	47,705,689	51,942,124	57,023,369
55	44,175,844	47,770,516	52,019,254	57,116,653
56	44,231,207	47,835,511	52,096,618	57,210,246
57	44,286,712	47,900,693	52,174,216	57,304,150
58	44,342,362	47,966,058	52,252,051	57,398,367
59	44,398,156	48,031,605	52,330,123	57,492,896
60	44,454,097	48,097,335	52,408,433	57,587,740

	80	81	82	83
0	57,587,740	63,924,495	71,852,975	82,055,127
1	57,682,901	64,042,118	72,002,006	82,249,986
2	57,778,381	64,160,180	72,151,659	82,445,779
3	57,874,180	64,278,683	72,301,942	82,642,513
4	57,970,302	64,397,632	72,452,863	82,840,196
5	58,066,748	64,517,028	72,604,421	83,038,833
6	58,163,520	64,636,873	72,756,618	83,238,436
7	58,260,619	64,757,168	72,909,461	83,439,009
8	58,358,049	64,877,918	73,062,954	83,640,561
9	58,455,810	64,999,124	73,217,100	83,843,097
10	58,553,904	65,120,789	73,371,903	84,046,626
11	58,652,333	65,242,916	73,527,367	84,251,153
12	58,751,099	65,365,508	73,683,499	84,456,680
13	58,850,205	65,488,566	73,840,302	84,663,213
14	58,949,653	65,612,095	73,997,782	84,870,760
15	59,049,444	65,736,097	74,155,942	85,079,327
16	59,149,581	65,859,675	74,314,786	85,288,957
17	59,250,065	65,985,531	74,474,318	85,499,628
18	59,350,898	66,110,967	74,634,544	85,711,347
19	59,452,082	66,240,886	74,795,468	85,924,121
20	59,553,618	66,363,291	74,957,095	86,137,958
21	59,655,506	66,490,185	75,119,429	86,352,864
22	59,757,728	66,617,572	75,282,475	86,568,849
23	59,860,346	66,745,453	75,446,238	86,785,921
24	59,963,291	66,873,831	75,610,721	87,004,089
25	60,066,612	67,002,708	75,775,928	87,223,362
26	60,170,285	67,132,088	75,941,864	87,443,750
27	60,274,319	67,261,972	76,108,533	87,665,261
28	60,378,718	67,392,365	76,275,941	87,887,909
29	60,483,482	67,523,270	76,444,091	88,111,704
30	60,588,615	67,654,691	76,612,989	88,336,657

SECANTIVM.

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	80	81	82	83
30	60,588,615	67,654,691	76,612,989	88,336,657
31	60,694,118	67,786,629	76,782,641	88,562,776
32	60,799,995	67,919,089	76,953,050	88,790,069
33	60,906,246	68,052,073	77,124,223	89,018,543
34	61,012,875	68,185,585	77,296,165	89,248,201
35	61,119,882	68,319,630	77,468,882	89,479,054
36	61,227,271	68,454,208	77,642,381	89,711,108
37	61,335,043	68,589,313	77,816,665	89,944,373
38	61,443,202	68,724,977	77,991,740	90,178,856
39	61,551,749	68,861,175	78,167,612	90,414,568
40	61,660,686	68,997,920	78,344,287	90,651,519
41	61,770,013	69,135,315	78,521,769	90,889,717
42	61,879,735	69,273,018	78,700,066	91,129,181
43	61,989,853	69,411,469	78,879,183	91,369,917
44	62,100,367	69,550,434	79,059,128	91,611,941
45	62,211,280	69,689,963	79,239,905	91,855,265
46	62,322,594	69,830,059	79,421,520	92,099,899
47	62,434,312	69,970,726	79,603,976	92,345,849
48	62,546,437	70,111,267	79,787,381	92,593,126
49	62,658,971	70,253,786	79,971,439	92,841,739
50	62,771,918	70,396,188	80,156,456	93,091,699
51	62,885,274	70,539,174	80,342,336	93,342,963
52	62,999,049	70,682,751	80,529,087	93,595,620
53	63,113,241	70,826,919	80,716,713	93,849,647
54	63,227,855	70,971,684	80,905,219	94,105,066
55	63,342,890	71,117,047	81,094,612	94,361,964
56	63,458,352	71,263,014	81,284,899	94,620,181
57	63,574,240	71,409,586	81,476,087	94,879,901
58	63,690,559	71,556,760	81,668,183	95,141,050
59	63,807,309	71,704,564	81,861,195	95,403,639
60	63,924,495	71,852,975	82,055,127	95,667,689

L

	84	85	86
0	95,667,689	114,737,188	143,355,808
1	95,933,204	115,119,970	143,954,694
2	96,200,195	115,505,313	144,558,602
3	96,469,673	115,893,242	145,167,595
4	96,738,655	116,283,797	145,781,740
5	97,010,253	116,676,991	146,401,101
6	97,283,267	117,072,851	147,025,745
7	97,557,932	117,471,403	147,655,740
8	97,834,057	117,872,815	148,291,169
9	98,111,843	118,276,840	148,932,108
10	98,391,211	118,683,794	149,578,791
11	98,672,171	119,093,414	150,230,941
12	98,954,738	119,506,013	150,888,966
13	99,238,930	119,921,335	151,552,578
14	99,524,766	120,339,695	152,222,283
15	99,812,250	120,760,985	152,897,946
16	100,101,400	121,185,232	153,579,394
17	100,392,329	121,612,482	154,267,179
18	100,684,851	122,042,752	154,961,155
19	100,979,193	122,476,076	155,661,396
20	101,275,259	122,912,485	156,368,008
21	101,572,962	123,352,014	157,081,063
22	101,872,522	123,794,696	157,800,648
23	102,173,854	124,240,732	158,526,854
24	102,476,971	124,689,836	159,259,771
25	102,781,890	125,142,353	159,999,560
26	103,088,639	125,598,007	160,746,121
27	103,397,202	126,057,149	161,499,724
28	103,707,656	126,519,656	162,260,744
29	104,019,959	126,985,568	163,028,671
30	104,334,254	127,454,936	163,804,188

SECANTIV M.

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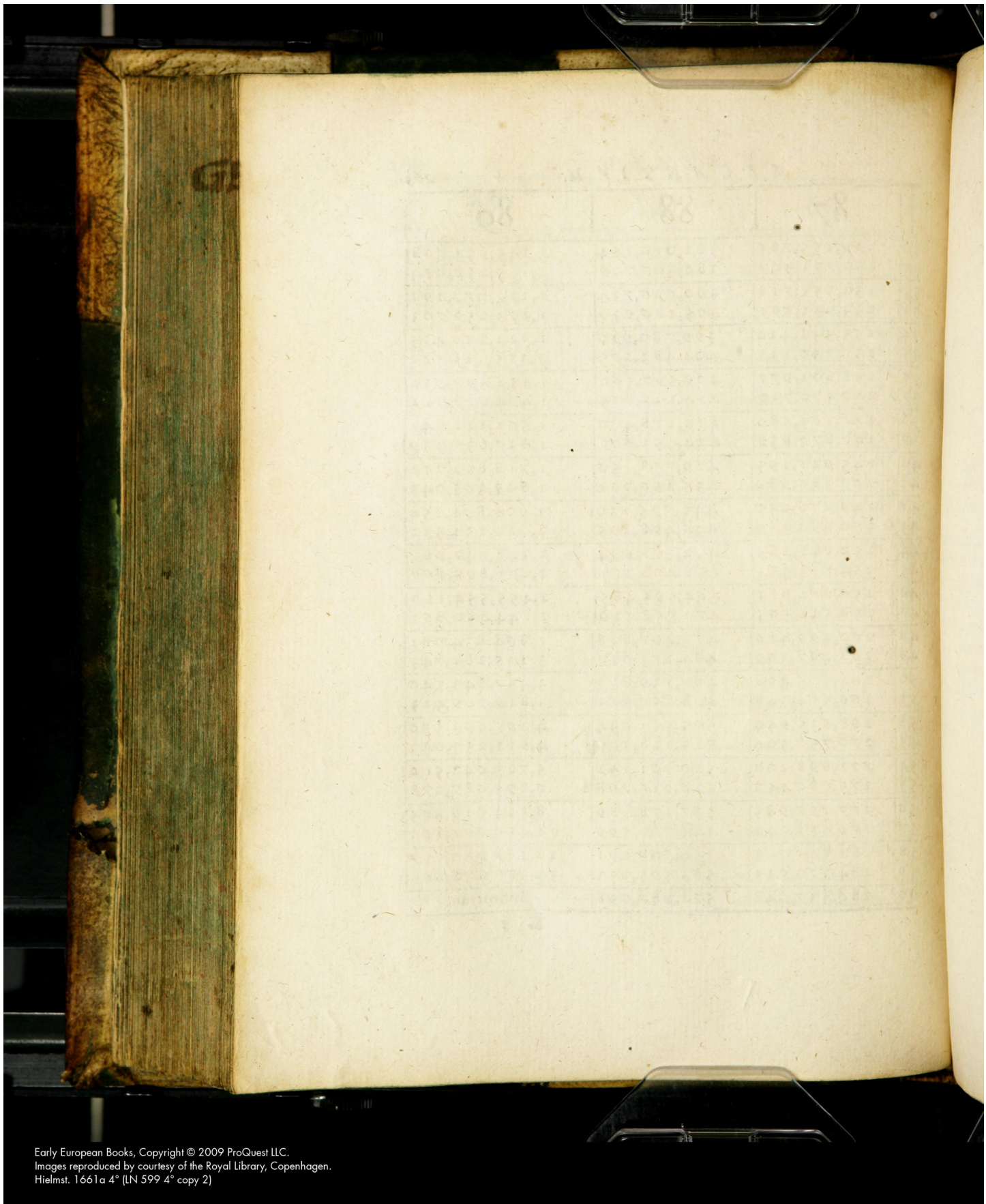
	84	85	86
30	104,334,254	127,454,936	163,804,188
31	104,650,345	127,927,785	164,586,836
32	104,968,474	128,404,152	165,377,268
33	105,288,542	128,884,078	166,175,067
34	105,610,566	129,367,604	166,980,877
35	105,934,564	129,854,921	167,794,536
36	106,260,557	130,345,812	168,615,879
37	106,588,558	130,840,395	169,445,585
38	106,918,589	131,338,917	170,283,495
39	107,250,680	131,841,076	171,129,820
40	107,584,955	132,347,264	171,984,431
41	107,921,201	132,857,174	172,847,712
42	108,259,554	133,371,390	173,719,700
43	108,600,151	133,889,600	174,600,528
44	108,942,779	134,411,312	175,490,331
45	109,287,702	134,937,471	176,389,247
46	109,634,817	135,467,749	177,297,417
47	109,984,143	136,002,235	178,215,000
48	110,335,695	136,540,955	179,142,131
49	110,689,503	137,083,887	180,078,954
50	111,045,597	137,631,223	181,025,551
51	111,403,988	138,183,016	181,982,628
52	111,764,699	138,739,177	182,949,802
53	112,127,750	139,299,830	183,926,988
54	112,493,167	139,865,032	184,915,009
55	112,861,097	140,435,034	185,913,698
56	113,231,316	141,009,514	186,922,883
57	113,604,036	141,588,910	187,943,432
58	113,979,204	142,172,885	188,975,184
59	114,356,941	142,761,897	190,018,342
60	114,737,188	143,355,808	191,073,059

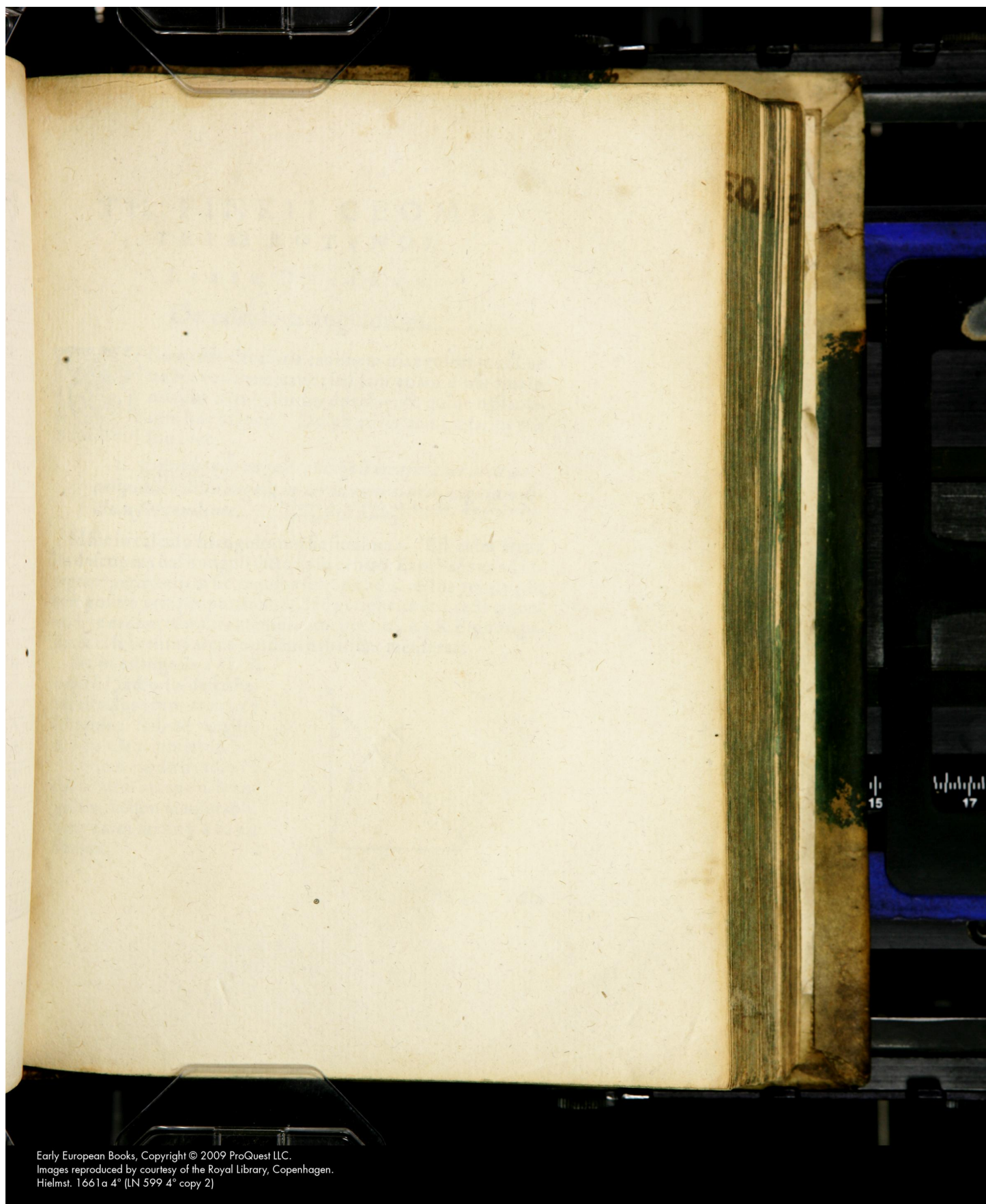
L 2

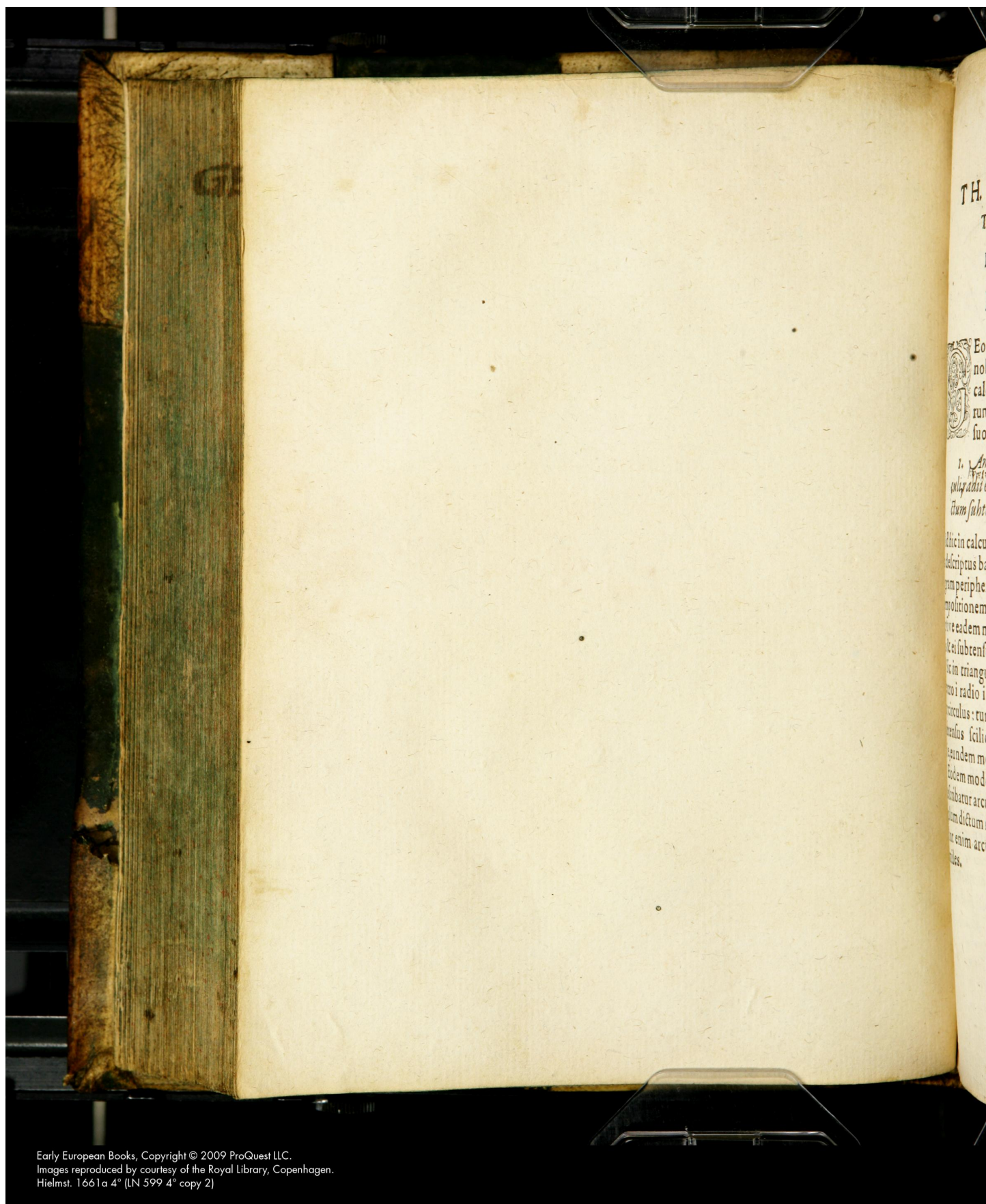
	87	88	89
0	191,073,059	286,537,048	572,987,098
1	192,139,567	288,943,841	582,696,234
2	193,218,044	291,391,404	592,740,072
3	194,308,693	293,880,683	603,139,919
4	195,411,723	296,413,087	613,907,444
5	196,527,729	298,990,299	625,070,305
6	197,656,182	301,611,807	636,642,580
7	198,797,665	304,279,687	648,655,621
8	199,952,408	306,996,123	661,126,359
9	201,120,639	309,760,533	674,090,521
10	202,303,011	312,576,192	687,573,461
11	203,498,943	315,442,491	701,612,741
12	204,709,121	318,361,849	716,229,489
13	205,934,200	321,336,774	731,453,951
14	207,173,596	324,366,765	747,356,168
15	208,428,431	327,455,509	763,965,262
16	209,698,119	330,602,545	781,323,254
17	210,983,811	333,811,800	799,494,739
18	212,284,914	337,082,830	818,524,878
19	213,602,421	340,419,652	838,490,069
20	214,936,837	343,823,403	859,453,551
21	216,287,319	347,294,586	881,484,374
22	217,655,350	350,837,799	904,682,629
23	219,040,792	354,454,051	929,134,899
24	220,443,981	358,145,679	954,945,691
25	221,865,261	361,914,968	982,231,457
26	223,305,005	365,763,113	1,011,112,129
27	224,763,453	369,695,332	1,041,753,449
28	226,241,278	373,713,015	1,074,309,940
29	227,738,558	377,818,975	1,108,967,170
30	229,255,785	382,016,194	1,145,934,768

	87	88	89
30	229,255,785	382,016,194	1,145,934,768
31	230,793,360	386,307,709	1,185,438,054
32	232,351,718	390,696,734	1,227,777,193
33	233,931,261	395,186,630	1,273,252,703
34	235,532,422	399,780,916	1,322,226,495
35	237,156,211	404,483,275	1,375,118,522
36	238,801,972	409,397,566	1,432,397,932
37	240,470,730	414,227,875	1,494,678,912
38	242,163,582	419,278,406	1,562,622,042
39	243,879,838	424,453,607	1,637,036,239
40	245,621,193	429,758,156	1,718,892,212
41	247,386,980	435,196,961	1,809,365,043
42	249,178,956	440,775,230	1,909,891,150
43	250,996,450	446,498,305	2,022,234,532
44	252,841,285	452,371,994	2,148,642,981
45	254,713,463	458,402,271	2,291,895,669
46	256,612,911	464,595,485	2,455,554,199
47	258,541,565	470,958,329	2,644,450,861
48	260,499,426	477,497,828	2,864,834,681
49	262,487,160	484,221,619	3,125,282,743
50	264,505,458	491,139,838	3,437,843,546
51	266,554,348	498,256,113	3,819,709,423
52	268,635,944	505,581,634	4,297,193,536
53	270,750,304	513,128,395	4,911,255,640
54	272,898,206	520,901,152	5,729,642,566
55	275,080,457	528,915,798	6,875,687,278
56	277,297,985	537,178,089	8,594,018,365
57	279,551,349	545,702,599	11,458,691,197
58	281,841,763	554,505,091	17,188,036,597
59	284,170,013	563,593,031	34,376,072,269
60	286,537,048	572,987,098	Infinitum.

L 3







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TH. FINKII GEOME-
TRIAE ROTYNDI,
LIBER DECIMVS.

De calculo triangulorum.

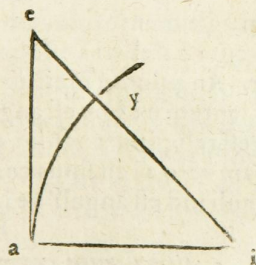
Geometria circularis canonem triangulorum adhuc nobis communicavit: sed jam etiam usum ejus in calculo triangulorum docebit: & quidem planorum hoc in loco. Desphæricis enim inferius erit suo loco.

1. *Amplitudo anguli trianguli mensuratur arcu circuli adit e dicto angulo in terminum cruris, angulum dictum subtendente.* aliter in istis aliis, descripti, angulis d. d. d.

Id hic in calculo triangulorum sic sumimus. Est enim arcus ita descriptus basis anguli sectoris in centro: Et ut basis ea ad integram peripheriam sic angulus sectoris ad 4 rectos per 5.e.3.& compositionem proportionum. Sed peripheria & 4 recti æquatur siue eadem mensura mensurantur per 2.c.3.e.5.R. Ergo angulus & ei subtensus arcus eandem habebunt mensuram.

Sic in triangulis aei. Si centro i radio ia describatur circulus: tum arcus ay subtensus scilicet angulo aie, eundem metietur.

Eodem modo si radio ie describatur arcus eu. is angulum dictum mensurabit. Sunt enim arcus ya & eu similes.



M Vnde

Id enim jam est demonstratum ut e a est sinus complementi anguli a ei nempe anguli e i a. Est enim angulus i. compl. anguli e ut patuit.

Hinc jam datis angulis trianguli rectanguli, laterum ratio dabitur. Qua de re est 30. p. 1. Regiom. de triangulis. ut si detur angulus e. gr. 30. erit angulus a i e gr. 60. Horum angulorum sinus ex canone jam dantur: nempe a i 5,000,000. e a vero 8,660,254. in ea videlicet mensura in qua radius e i assumitur 10,000,000. Quare ratio ei ad a i est ratio, 10,000,000 ad 5,000,000. ad e a vero ut 10,000,000 ad 8,660,254. & crurum inter se a i ad a e ut 5,000,000 ad 8,660,254. Copernicus hanc ad rem, ut & in reliquo hoc calculo diametro & inscriptis integris utitur 13. c. 1.

Et

4. Si crus alterum recti fiat radius ex angulo obliquo: reliquum est tangens anguli dicti, basis vero ejusdem secans.

Ea de re est apud Rheinholdum 8 præc. tabul. duæ. & apud Rheticum in dialogo de canone triangulorum. Esto rursus triangulum a e i. & centro i radio i a describatur circulus a y. dico a e nempe crus recti reliquum esse tangentem anguli oppositi nempe i ex quo circulus descriptus est: & basin e i esse ejusdem anguli secantem. Nam ut ex definitionibus tangentis & secantis patet a e & e i sunt arcus a y hoc est per i e anguli e i a tangens & secans.

Hinc jam rursus datis angulis dabitur ratio laterum: si crus alterutrum sit radius. Sic enim angulus a ei gr. 30. erit angulus e i a gr. 60. Hujus tangens a e datur & secans ex suo qualibet canone illic 17,320,508 hic 20,000,000. Quare ratio a i ad a e est ut 10,000,000 ad 17,320,508 ad e i ut 10,000,000 ad 20,000,000.

itaque siue basis recti sumatur pro radio siue crus recti: datis angulis laterum dabitur ratio in assumpta mensura. Quod si vero & latus dati trianguli unum in aliqua mensura detur: per re-

gulam



Uti in precedenti: ita quæq; in hoc tractatu auctor, quæ modo in triangulo rectangulo, nunc angulo dato, ratio laterum, & quæ item e canone tangentium & secantium inveniantur. Si n: crus recti anguli dato oppositi sit radius, reliquum erit tangens complementi, basis recti erit secans complementi anguli dati.

[Cop: In triangulo rectang. dato uno angulo pter rectum imotesit facile anguly reliquy, qd ambo æquant recto. 90.] Notum igitur qd pter rectu, e subtrahat a qua = tangente, remanet reliquum.]

173205080 ei ei ea ea

(17) 10,00,0000 20 8,660,254

Factus per secundum & tertium in primum divisus quotum invenit 17 & remanet 3,205,080. Quæ si per doctrinam reductionis Arithmeticæ per 60 multiplices & in radium dividas continuè: invenies minura 19 & 14 secunda ferè. ut videre hic licet.

1,000,000.	60.	320,508	
		60	
		19 230,480	prima
		60	
		13 828,800	secunda
		60	
		49 728,000	tertia

Et sic deinceps ad scrupula posses continuare sexta antequam reliquum nullum invenires. Verum sufficit huc usque esse progressum: imo ad prima transisse satis est: abjectis secundis quæ 30 minora sunt: alias si majora sint pro iis assumitur, primum cum voce ferè.

Secundo data basi cum crure anguli invenientur. *Ita ut basis in data mensura est ad crur datim: si finis in teget est ad sinum anguli cui data latet est oppositum.*

Detur in eadem figura ei basis 20. at crur recti ai 10. si hæc horum laterum magnitudines sint siue laterum rationis termini perinde est: nec alia erit calculi ratio. His igitur datis quærun- tur anguli. Cum itaq; ai per 2. e. sit sinus anguli a ei is vero de- tur in ea mensura in qua datur basis ei 20. Erit ergo ut 20 ad 10. sic 10,000,000 radius assumptus ad 5,000,000 sinum anguli ad e in mensura assumpta

ei ei ai ai
2 10,000,000 1 5,000,000.

Sinus igitur iste in canone sinuum in sua parte nempe in- tiore quæsitus in marginibus supero quidem gr. 30 sinistro mi-
M 3 nutum

nutum nullum exhibet. Quare angulus $a e i$ erit $gr. 30$. Sed & hinc angulus $ad i$ dabitur nempe $gr. 60$. tanquam prioris cōplementum, aut recti & $gr. 30$ de duobus rectis reliquis per 9. e. 6. R.

Et

6. Radius est ad tangentem anguli, ut Crus recti & distanti ad crus reliquum.

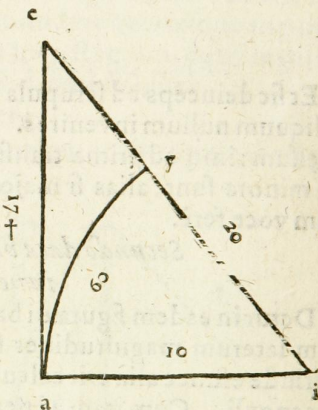
Hoc elementum docebit: dato angulo cum crure, reliqui cruris inventionem: & datis cruribus, angulorum investigationem monstrabit. Ea de re est apud Rheticū in dialogo suo: & Rhemholdum præc. 9. tab. direct.

Primò ergo dato crure cum angulo reliquum crur invenitur.

Sic igitur trianguli rectanguli $e a i$ datum crus $a i$ 10. & angulus $a i e$ grad. 60. Quæritur crus reliquum $a e$ in ea mensura in qua $a i$ datur.

Fiat itaque $i a$ radius: erit per 4. $e a e$ tangens anguli $e i a$.

Quare ex canone tangentium dabitur $a e$ 17,320,508 in mensura assumpta. Ergo si cum $a i$ est 10,000,000. tū $a e$ est 17,320,508. cum $a i$ datur 10 erit $a e$ 17. & paulo plus videlicet 19', 14" plane ut ante.



$a i$	$a i$	$a e$	$a e$
1,000,000.	1.	17,320,508	

Et sic dato crure ac angulo, crus reliquum invenimus.

• *Secundò datis cruribus anguli, in assumpta mensura aut in qua determinatur rectus, dabuntur.*

Dentur enim in præmisso schemate crura $a i$ quidē 2,500,000. at $a e$ 4,330,127.

Ex

Ex his cruribus anguli dati trianguli obliqui exquiruntur, fiat enim *a i* radius: erit *a e* tangens anguli *i* quæ cū detur in ea mensura in qua datur etiam *i a* radius: erit per regulam auream ut 2,500,000 ad 4,330,127 sic 10,000,000 ad 17,320,508.

<i>a i</i>	<i>a i</i>	<i>a e</i>
25	100	4,330,127.

atq; ea est tangens anguli *i* in assumpta mensura. quæ quæsitæ in canone tangentium monstrat gr. 60 pro angulo *i*. Quare angulus *e* erit gr. 30. in ea mensura quæ peripheriam statuit definitam partibus 360. Quod si alia detur peripheriæ mensura simul cum cruribus: ex superiori libro reduces angulos inventos ad datam mensuram. ut si detur anguli recti amplitudo 11. erit ut 90 ad 60 sic 11 ad $7\frac{1}{2}$ pro angulo *i*. & ut 90 ad 30 sic 11 ad $3\frac{2}{3}$ pro angulo *e*. Quod hic semel repetivisse sat est.

Hujus vero calculi exempla multa desumi possunt ex 2. lib. M. C. Ptolemæi: ubi de ratione umbrarum agit: multa etiam passim apud Geographos & Physicos alios leguntur. Nos sumemus illud Plinii quod Rheinholdus præc. 49. tab. direct. habet.

Plinius itaq; lib. 2. c. 74. vel ut alii legunt 73. sic de gnomone & umbra æquinoctiali loquitur: Meridiano tempore æquinoctii die in urbe Roma nona pars gnomonis deest umbræ. hoc est si in præmissa figura *a e* statuas gnomonem partium 9. erit *a i* umbra talium partium 8. Hinc inquirendus est angulus *a e i*. angulus scilicet inclinationis axis Æquatoris ad Horizontem: qui vulgò altitudo poli dicitur: à quo si nō ratione subiecto tamen differt. Si itaq; fiat *a e* radius: erit ut 9 ad 8 sic 10,000,000 ad 8,888,889 ferè.

<i>a e</i>	<i>a e</i>	<i>a i</i>	<i>a i</i>
9.	10,000,000	8.	8,888,889

Atq; hæc *a i* est tangens anguli *a e i* mensuræ assumptæ: quare ex canone tangentium dabitur angulus ipse e gr. 41,38'.

Simili modo erunt tractanda reliqua quæ dicto loco Plinius habet: & quæ apud Ptolemæum extant.

Tale est illud quod Vitruvius Alexandriæ umbram meridianam dicit æquinoctii die esse 3, quarum gnomon habeat 5. hoc est

est esse a e 5, a i 3. Ex quib. angulus a e i invenietur gr. 30. 58' ferè.

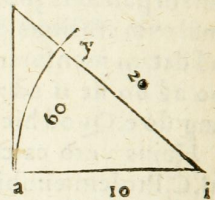
Et

7. Radius est ad secantem anguli, ut Crus ad iacens ad basin.

Hoc elemento: Dato crure cum angulo invenitur basis: Et rur-
sus data basi cum crure exquiruntur anguli.

Primò: Dato crure cum angulo invenitur basis.

Sit trianguli rectanguli e a i. datum crus
a i 10. cum angulo e i a grad. 60. Quæritur
hinc basis e i. fiat itaq; crus datum radius
circuli a y. constat jam e i esse secantem
anguli e i a. Ergo cum angulus i detur gr.
60. ipsa secans ex canone secantium dabi-
tur 20,000,000. in ea mensura in qua ra-
dius a i est 10,000,000. Ergo in qua a i est
10 in ea e i erit 20.



a i	a i	e i	e i
1.	10.	2.	20.

Eadem res erit si detur crus reliquum e a. Nam tum ut radius
ad secantem anguli e sic e a ad e i.

*Secundò: Data basi cum crure anguli ex-
quiruntur.*

Detur enim basis e i 20 crus a i 10. & crus a i fiat radius, erit er-
go e i secans anguli e i a. jam ut 10 ad 20 sic 10,000,000. ad
20,000,000. pro secante anguli i. Quate secantium canon mon-
strabit angulum i. grad. 60. & proinde reliquus erit gr. 30. nempe
angulus ad e. itaque & per sinus & secantes data basi cum crure
anguli exquiruntur: ut patuit supra 5 e, & hic apparet.

Atq; sic calculus triangulorum rectangulorum fuit: qui è datis
duobus præter angulum rectum aut lateribus aut latere & an-
gulo reliqua invenire docuit. Nam datis angulis tantum ratio la-
terum datur ut ad 3 & 4 e patuit. Sequitur hinc postulatam: tum
ipse obliquangulorum calculus.

Et

Et licet

8. Data summa aut differentia duarum peripheriarum vel angulorum & ratione sinuum, sigillatim utrumque, secernere.

Sunt de hoc postulato secundum & quartum Theonis lemma cyclicum 11. c. 1. & 21, 22, 23, 24. p. 4. Regiom. de triangulis. Quorum inventionis rationem illic perlegere potes. Nobis hæc erit proposita methodus.

1. ut semissis summe terminorum rationis sinuum ad differentiam semissis ac termini alterius, sic tangens semissis summe datæ ad tangentem peripheriarum qua minor quasitarum semisse summa minor, aut major, major est.

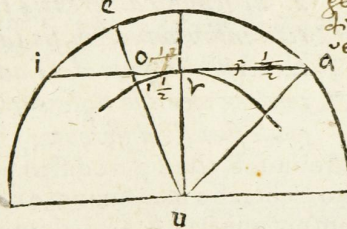
Esto in sequenti schemate data summa arcuum i e, e a gr. 40. Sitq; data ratio sinuum harum peripheriarum, hoc est ratio a o ad i o per 13. e. 5. ut 7 ad 4.

Quæruntur jam singulæ peripheriæ a e, e i. Ducantur radii u a in terminum inscriptæ. u y bifecans ut inscriptam sic summam peripheriarum erit ergo

angulus r u a grad. 20. cujus tangens est a r. illa datur ex canone 3,639,702. ex thesi $5\frac{1}{2}$. Nam i a est 11. ergo r a est $5\frac{1}{2}$. jam ergo ut 3,639,702 ad 10,000,000. sic $5\frac{1}{2}$ ad 15 & paulo ultra. nempe remanent 808,940. jam r o est tangens anguli o u r: eaq; datur in mensura ea in qua u r radius est paulo ultra 15. datur inquam nempe $1\frac{1}{2}$ differentia a r $5\frac{1}{2}$ & a o 7. vel differentia i r $5\frac{1}{2}$ & i o 4. Quare ex 6 e rursus ut u r datæ mensuræ ad radium, sic o r datæ mensuræ ad tangentem anguli u, hoc est arcus e y. Hinc jam sequitur calculus seu calculi ratio quam ante proposuimus. Nam

ut a r in data mensura $5\frac{1}{2}$ ad 3,639,702 in assumpta, tangentem

N scilicet



Addant termini rationis
1. semissis summa addita q.
2. Quæratu diff.
ferentia semissis summa &
alterius termini dati.
3. Quæratu tangentem dimi-
dia peripheriæ datæ vel an-
guli etiam 4. p. regulam
proportionum quare tan-
gentem diff. inter dimi-
dia arcuum & alteram in-
veniendoni, ponendo
a primo loco semissem
summa terminorum. 20
semissem 3tio tan-
gent: r ex tabula
quare arcuum tangen-
ti inventa correspon-
dentem, is aditur di-
midia summa peripheriæ
producit maiorem ar-
cui, ab eadem verò
dimidia summa detra-
his relinquitur minore
arcum q. situm.

scilicet anguli r u a. sic 15 + nēpe u r in data mēsurā ad 10,000,000.

Et ut 15 + ad 10,000,000. sic o r data mēsurā $1\frac{1}{2}$ ad 992,646 tangentem anguli o u r. Ex æquatione itaq; rationum ut semis-
sis terminorum rationis sinuum summæ ad differentiam semis-
sis alteriusq; termini, sic tangens semis- summæ datae ad tan-
gentem peripheriæ prosthaphæreseos. ut hic

a r	a r	o r	o r
$5\frac{1}{2}$	3,639,702	$1\frac{1}{2}$	992,646.

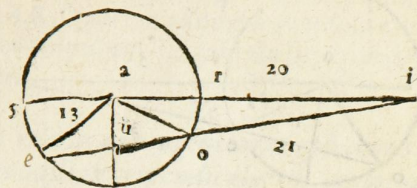
Tangens itaq; peripheriæ e y aut similis est 992,646. cui com-
petit ex canone tangentium gr. 5,46 prosthaphæreseos nempe:
quæ ablata semis- i y relinquit 14,26 addita semis- i a y cōponit
25,46. & ita peripheriarū quæstiarū major est 25,46 minor 14,26.

Detur jam peripheriarum differentia cum
ratione sinuum.

Erit itaq;

1. terminorum rationis. 2. ut semis- differentia terminorum rationis ad
terminum minorem, sic tangens semis- differen-
tia peripheriarum data ad tangentem, peripheria
minoris, semis- differentia aucta, minorem tan-
gente semis- differentia peripheriarum.
Est in subiecta figura differentia peripheriarum o r, e r data
ad e r minorem terminum gr. 40. Et sit ratio data sinuum o r, ad e r ut 20 ad 13.
quæ r e minorem terminum jam per puncta o & e inscripta recta continuetur donec con-
tineat e r minorem terminum. Currat cum diametro in i. erit per 14. e. 5. ratio o i ad i e ut 20 ad 13.
adde tangentem mediam. erit ergo o e 7. bisecetur o e erit u e $3\frac{1}{2}$. sed & a y bisecat arcum
loco positum arcum. e. erit ergo y e gr. 20. ejusque aut similis radio a u descripti tan-
gentem in tabula tan- gens u e. 3,639,702. in ea mēsurā in qua a u est 10,000,000. Ergo
per antecedentes rationes ut u e in data mēsurā $3\frac{1}{2}$ ad u e
3,639,702 sic e i data mēsurā 13 ad 13,518,893. assumptæ mēsuræ.
u e u e e i e i
 $3\frac{1}{2}$ 3,639,702 13 13,518,893.
Cognosce si major: jam si u e & e i componas habebis tangentem anguli u a r, hoc
rem arcum nosse in arcu y r.
pro ad arcum e tabula tangentium inventum
adde dimidiam differentiam peripheriarum & p d i t
q s i t m.

13,518,



ut ^{ens} e a ad ^y e u ^{reg. etu. bafis} sic radius ad ang. e a u

13	5	10,000,000	3,846,154	
Sinus inventus in canone sinuum exhibet			gr. 22, 37'	&c
parum ultra. Quare angulus e a u erit			gr. 22, 37'.	
proindeq; ejus complementum a e u			gr. 67, 23'.	

Rursus cum i u a triangulum sit rectangulum erit ut i a ad i u
sic rad. ad sin. ang. u a i

20 16 10,000,000. 8,000,000.
Sinus hic in canone sinuum quæsitus monstrat arcum grad.
53,7', 48" pro angulo u ai. Ergo angulus a i u erit gr. 36, 52', 12".
& sic habes trianguli a e i duos angulos: quos si conjunctim de
180 nempe duobus rectis auferas per 9. c. 6. R. relinquetur tibi
angulus e a i gr. 75, 45'.

e.	67, 22, 49''	180
i.	36 52 12	104 15'
<hr/>		
	104 15'	75 45

Atq; sic inquires angulos datorum laterum: si perpendicularis cadat intra triangulum: quod quando fiat in inventione segmenti u e docet H. e. 2.

Sit jam datum crus	a i	51
crus	a e	25
basis	e i	38

Ex his datis colligetur u e 7, & i u 45 per 11.e.2. unde & illud
constabit perpendicularem cadere extra.

N 3 jam

fit sine hac inventione dantur anguli: nempe quilibet est bes recti per 3. c. 10. e. 6. R. Quare in assumpta mensura erit gr. 60. Et similia compendia discipulum diligentem superioris Geometriæ latere non possunt.

Et

10. ut radius ad tangentem anguli cruris ac basis, sic segmentum basis, in perpendicularem, conterminum ad perpendicularem.

De hac perpendicularis inventione factæ sunt apud Regiom. propositiones 34, 36, 46, lib. 1. de triangulis.

Consequitur ex 6. e. ut in præmissis triangulis: si in primo triangulo cupias inquirere perpendicularem a u: & datus sit angulus a e u grad. 67, 23. & segmentum e u s. si cogites e u esse radium erit per 6. e.

ut radius	ad tang. ang. e	fic u e ad a u
10,000,000	24,003,779.	5 12

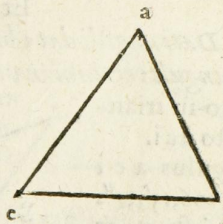
Itaq; perpendicularis erit 12. Eadem methodo alterius trianguli perpendicularem invenies.

Et

11. Latera sinibus oppositorum angulorum sunt proportionalia.

Hoc elementum sæpissimè & crebro ab Regiomontano & inculcatur & proponitur maxime 41, 48. p. 1. & 1, 6. p. 2. de triangulis.

Esto triangulū obliquangulum (nam de rectangulo ad 3. e. fuit, a e i: & quidem varium sive lateribus inæqualibus. Nam si latera sint equalia anguli oppositi quoq; æquantur per 10. e.



6. R. proindeq; sinus angulorum æqualium sunt æquales per 15 e 5. Sit itaq; varium dico esse a e ad sinum anguli a i e, sic a i ad sinum anguli a e i.

Contri-

per *ue*, itaq; ut *a* est ad sinum anguli *e*, sic *a* est ad sinum anguli *i*. Datur autem *a* *i*, datur *a* *e*. canon etiam sinuum suppediat sinum anguli gr. 106, 15, 37", hoc est per 8 *e* 5 sinum gr. 73, 44, 23" nempe 9, 599, 997. Ergo per regulam auream dabitur sinus anguli *a* *e* 4, 705, 881.

<i>a</i>	<i>i</i>	<i>a</i>	<i>e</i>	<i>e</i>	<i>i</i>
51	25	9, 599, 997	4, 705, 881		

Quare ex canone sinuum dabitur ipse angulus *i* gr. 28, 4' & parum ultra, nempe 20".

jam datis his duobus angulis ex thesi & calculo: reliquus ad *a* erit gr. 45, 40, 3".

<i>e</i> .	106, 15, 37"	180
<i>i</i> .	28, 44, 20	134, 20
<hr/>		<hr/>
	134, 19, 57	45, 40

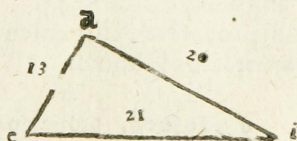
Quod si jam velis inquirere reliquum dati anguli *crus*: nempe *e* *i*. prædictum elementum inveniet 38. Nam ut sinus anguli *i* ad *a* sic sinus anguli *a* ad *e*.

<i>i</i> .	<i>a</i> .	<i>a</i>	<i>e</i>	<i>e</i>	<i>i</i>
4, 705, 881.	7, 152, 964.	25.			38.

Exemplum aliud.

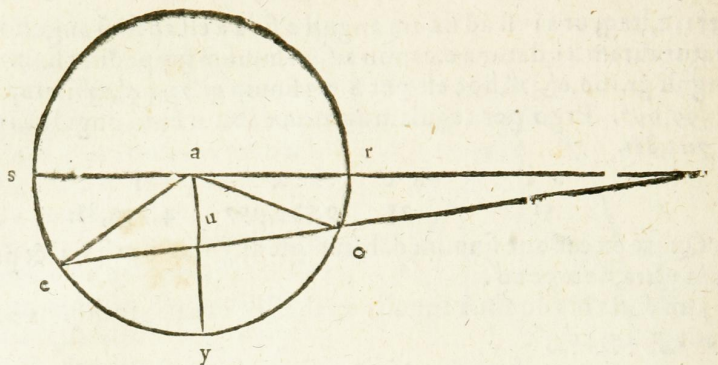
Sit in triangulo appositio angulus *e* acutus grad. 67, 22', 49": detur etiam *a* *e* 13. *a* *i* 20. Quærentur reliqui anguli & latuse *e* *i*.

Verum data non sufficiunt nisi enim dederis acutus ne sit aut obtusus angulus à crure dati anguli subtenus: ejus mensuram non definies. Nam si in hoc schemate ita ex elemento præmisso ratiocinatus fueris:



ut se habet *a* *o* seu *a* *e* (sunt enim radii ejusdē circuli) ad sinum anguli *i*. sic *a* *i* ad sinum anguli oppositi. Verum dixisti: at quem arcum competentem sinui desumes? competentem ne angu-

O . lo aoi



Io a o i hoc est majorem peripheria quadrantis: an ne competen-
tem angulo a o e hoc est per 2. e. 7. R. angulo a e o acuto. cum
idem sinus his competat: latus etiam æquale & acuto & obtuso
adaceat. Quare cum triangulum his datis tam anceps sit & du-
bium: rectè Regiom. 51. p. 1. de triangulis monet datum angulum
acutum cum crure & basi ad reliqua inveniendâ non sufficere.
Quare angulum oppositum cruri dati anguli definiamus neces-
se est: sit ne acutus an obtusus. itaq; ut ad triangulum datum de-
scendamus: angulum præter dicta data, a i e damus acutum. Hinc
per præmissas ratiocinationes inveniẽt angulus a i e gr. 36, 52', 12"

a i	a e	e	i
20.	13.	9,230,780.	6,000,006.

jam cum noti sint duo anguli e & i ille ex thesi hic ex calculo:
erit angulus ad a. gr. 75, 45.

jam pro latere e i inveniendâ ratiocinatio præcedens valet &
inveniet latus ipsum 21.

i	a	a e	e i
6,000,006.	9,692,309.	13.	21.

Et sic data basi datoq; crure dati anguli obtusi reliqua inve-
niuntur: data vero basi datoq; crure anguli acuti notaque specie
anguli cruri dato oppositi reliqua inveniuntur. Sed plura nobis
idem elementum suppeditat.

Et.

Et

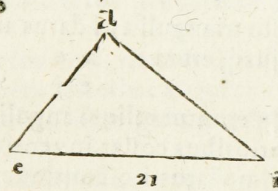
14. *Datis angulis cum uno trianguli latere, reliqua latera vestigantur.*

Ea de re est apud Regiomontanum 52, 53. p. 1. ubi quæsitæ pro-
ut in antecedentibus fecit in deductis ad rectangula obliquan-
gulis invenit. idem & alii præter Copernicum cum Ptolemæo
fecerunt. Sed nos per plura querere nolumus cum possimus per
pauciora: rideretur sane qui secundum peripheriam veller cir-
cumire cum posset secundum subtensam ingredi: nec perpendi-
cularem aut segmenta lateris secta perpendiculari inquirere est
necesse: non enim hæc quærenda proponuntur: Et si propone-
rentur: ex superioribus inventionis methodus esset. Et Regiom.
4. p. 2. hanc methodum quæ hic erit retinet. Sed ad elementum.
sint in triangulo a e i data.

Angulus a e i 67, 22', 49"
Angulus a i e 36, 52, 12
Erit Angulus i a e 75, 45.

Datum sit etiam latus e i 21. Quærantur jam e a & a i.

inveniantur, illud quidem
hoc vero 20. ut ex sequen-
ti terminorum ex elemen-
to proposito dispositione
patet.



I.			
a	i	e i	a e
9,692,309.	6,000,006.	21.	13.
II.			
a	e	e i	a i
9,692,309.	9,230,780.	21.	20.
Vel			
i	e	a e	a i
6,000,006.	9,230,780.	13.	20.

O 2 Quod

Quod si duo dentur latera & anguli: jam unica tantum inventione lateris est opus: quod nemo non intelligere potest. Nos sumpſimus ea quæ dari minimum debent.

jam itaq; & datis tribus lateribus angulos invenimus: angulis datis laterum proportionem cognovimus: dati anguli basi ac crure datis ad angulorum reliquorum ac tertii lateris cognitionem pervenimus: datis angulis cū latere reliqua vestigavimus. Superest jam adhuc alius casus: nempe datis dati anguli cruribus angulos ac tertium latus eruamus. inventio hæc apud Regiomont. est 49. p. 1. ubi perpendicularem in alterutrum crurum inquirat & segmenta cruris secti: Est etiam 2. p. 2. ac nimis laboriosa & rædiosa. Quare ex superiori doctrina deducto calculo brevi & facili eoq; novo frui.

Et

15. ut semissis summa crurum ad differentiam summa semissis alteriusq; cruris, sic tangens semissis anguli crurum exterioris ad tangentem anguli quominor interiorum semisse dicti reliqui minor est, aut major, major. *exterioris*

Est trianguli a e i datus angulus ad e. gr. 67, 22', 49".

Ejusq; crura

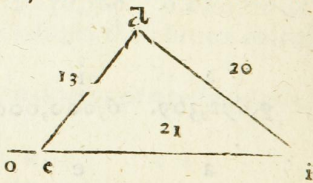
a e	13.
e i	21.

Quærentur reliqui anguli. Nam de latere inventis angulis ex superioribus constat. inventionis hujus methodum ex 8 e didici.

Primo latus i e continuetur in o. Erit angulus o e a. æqualis angulis ad a & i. per 1. c. 9. e. 6. R. At angulus o e a datur nempe reliquus ad duos rectos anguli a e i per 1. c. 8. e. 5. R. datur itaque inquam grad. 112. 37', 11". Quare summa angulorum a & i datur.

Secundo datur etiam ratio sinuum angulorum a & i. Nam ut e i ad e a sic sinus anguli a ad sinum anguli i per 11. e.

Iraq; data summa angulorum a & i. data etiam ratione sinuum separa-



separatorum angulorum: sigillatim etiam dabuntur i & a. ea methodo quam ex 8 e jam proposuimus.

Terminos itaq; aureæ regulæ colligamus. Ratio sinuum anguli a ad sinum anguli i est ut 21 ad 13. adde terminos: semissis 17. erit pro primo. jam aufert 17 de 21, aut de 17 aufer 13. differentia 4 erit pro secundo.

Summa angulorum datur 112, 37', 11".

Ergo semissis est 56, 18', 35". Hujus tangens ex canone datur 149,999. ne scrupulosius omnia persequamur.

Ex hisce tribus aurea regula inueniet 35,294.

17. 149,999. 4. 35,294.

Tangentem scilicet anguli quo angulus i minor est quam semissis anguli a e o.

Dabitur itaq; ex canone sinuum gr. 19, 26', 24". in desumendo autem duas primas dextras tangentium notas prætermitte ea conditione qua supra monui. Et in præmissis elementis observare potuissim: sed volui plenos sumere numeros ne turbarentur tyrones. Qui plenius uti scit: in usu facile pro ratione quosdam præcidere potest.

jam cum notus sit dimidius angulus a e o, notus etiam sit angulus quo dimidius angulum i superat. ulterius angulus i non latebit: ablato igitur angulo gr. 19, 26', 24" de angulo gr. 56, 18', 35". reliquus erit angulus a i e gr. 36, 52', 11".

Rursus si addas prostaphæresin ad semissem anguli exterioris: summa est pro angulo e a i gr. 75, 44'. De magnitudine anguli ex 11. e. 6. R. judicium fiet: cum dentur latera iis opposita.

56,	18',	35"
19,	26,	24
<hr/>		
36,	52,	11
<hr/>		
75,	44,	59

O 3 Exemplum

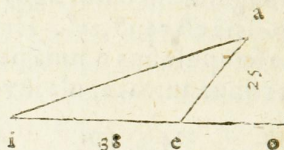
Exemplum aliud.

Detur angulus a e i gr. 106, 15', 37".

Crus a e	25
Crus e i	38.

Quærentur anguli reliqui.

Hic rursus quia
datur angulus a e i.
dabitur angulus a e o
grad. 73, 44', 23".
Summa angulorū
a & i.



Sed & ratio sinuum anguli i ad a est ut a e 25 ad 38. Quare per 8 e dabitur ipse angulus i & a. illic grad. 28, 4', 21". hic grad. 45, 40'.

Colligamus terminos aureæ regulæ.

Erit ergo primus $31\frac{1}{2}$.

a e	25
e i	38
<hr/>	
63	

Secundus erit differentia $31\frac{1}{2}$ & 25 nempe $6\frac{1}{2}$.

Tertius erit tangens semissis anguli a e o nempe 74,999.

Hinc regula aurea invenit quartum 15,476.

$31\frac{1}{2}$	74,999.	$6\frac{1}{2}$	15,476.
-----------------	---------	----------------	---------

tangentem nempe anguli in ea mensura in qua radius concipitur 100,000. anguli, inquam, quo anguli a e o semissis major est angulo i. Datur autem hic ex canone grad. 8, 47', 50". Ergo de 36, 52', 11", relinquit angulum a i e grad. 28, 4', 21". At cum grad. 36, 52', colligit grad. 45, 40' pro angulo a. latus a i ex superioribus datur.

Atque

Atque sic expositus nobis sit insignis ille & aureus triangulorum calculus: cujus usus in Astronomia, Geodæsia imò artibus omnibus liberalibus & vita tota conspicuus est. In eo itaq; sedulo & serio, philomathes, te exerceas oportet si fructum hunc uberrimum consequi volueris. Habes hic exposita ea: quæ generalia videbantur & sunt. in specie enim de æquilateris aliquid, rursus nonnihil de æquicrūro proponere noluimus: propterea quod calculus communis sit. Si vero quæ occurrunt in datis compendia prout ad 9 e monstravi: ea non nisi à cæcis in Geometria non videbuntur. Omisimus etiam ea in quibus tanquam speciebus calculus hic generalis exerceri posset: quod esse id artis non videbatur. Regiomontanus aliquot casus in secundo libro de triangulis collegit: quos illic videre potes. Cujus certe libri à studiosis avidè legi debent: & cum fructu legi possunt. Habui id quidem in animo ut calculum Regiomontani itemque Ptolemæi & Copernici cum hoc præfenti conferrem: Verum ego hinc tyrones turbari existimavi: nec ab horum artificum immortalitati consecratorum monumentis abducere studiosos volui. ubi hic perceptus fuerit: facile collatio institui poterit. Nos brevissimam, uti spero, viam ingressi sumus: si deviavimus certè reducem æquo animo, & animo grato ferre possumus: & feremus.

Ne tamen nullus indicetur præstantissimi hujus
calculi usus: fructum Geometricum
qui hinc promanat sequen-
ti libro exponemus.

TH. FIN.

TH. FINKII GEOME-
TRIAE ROTVNDI,

LIBER VNDECIMVS.

De Geodæsia rectorum.



Calculus triangulorum planorum expositus facilem suppeditat rectorum Geodæsiæ per radium.

Hic fructus calculi Geometrici Geometricus est: per omnia magnitudinum genera diffusus, Lineas enim hæc Geodæsia metitur: ergo & superficies & corpora metietur: atq; hac arte areas triangulorum exquirat, sed & triangulata è triangulis composita sunt: quare metiendis triangulorum areis, metietur & areas triangulorum. Sed & diametros circulorum tanquam rectoras metitur, metietur itaq; & areas circulorum, omniumq; ejus segmentorum. Sic eadem hæc geodæsia bases & altitudines corporum metitur: metitur itaque & ipsas soliditates. usum hunc nobis potissimum præstat trianguli rectorum calculus. Vulgò & à præstantibus mathematicis triangulum rectorum magister mathematicos appellatur. Et certè vires in Geometria præcipuas habet. Magisterium & hic verum deprehenditur in geodæsia rectorum.

Sed instrumento geodætico opus est. Eam ad rem alii quadratum Geometricum adsciscunt: nonnulli gnomonè seu simplicem normam in consilium vocant: aliis per umbras mensura placuit: aliis per speculum: quam utramque in opticis Euclides retinuit: alii quadrantem adhibent, & eum vel simplicem vel cum inscripto quadrato: alii alia arripuerunt instrumenta. Arripit etiam nonnullis radius: qui, quasi à sancto illo patriarcha jam olim inventus sit, baculus jacobii vulgò dicitur. Nos ex iis duo selegimus radium & quadrantem simplicem: propterea ut collatione facta geodæsia & certior & facilius esset. Vulgò hæc duo instru-

instrumenta duobus quoque insigniuntur nominibus. Nos eodem nomine Radium vocamus. Et certè si rem rectè perpendamus, instrumentum idem est. instrumentum sane per antiquum & verè Geometricum: hoc est magnitudinibus metiendis cuiuscunq; materiæ aptum. Sic & metiendis terris usurpatur. ut est apud Virgil. 3. Eclog.

— Ecquis fuit alter,

Descriptit Radio totum qui gentibus orbem?

Et astris loco & ordine definiendis, cunctisque superlunaris istius civitatis regionibus ac viis describendis eidem illi poëtæ aptum instrumentum visum est.

— Cœliq; meatus,

Describent Radio: & surgentia sidera dicent.

Sed satis de usu & fructu hujus geodæsiæ: satisq; de instrumenti nomine: ejus fabricam & usum doceamus.

2 *Radius est norma crurum inequalium: alterius recti metienda magnitudini reliqui paralleli.*

Quid, inquis, facis idem instrumentum baculum & quadrantem? an non baculus est ut ipse definis norma crurum inequalium? quid simile in quadrante? an non crura recti hic sunt radii & proinde te ipso teste 2. e. i. æquales? quam cupis differentiam & dissensionem horum instrumentorum majorem? ubi peripheria quadrantis in baculo conspicitur? Sed heus quid dicam: audi crurum definitiones: & situm eorum tam in quadrante quam baculo deprehendes. Fateor quidem actu ipso existere in baculo: non item in quadrante: ubi tamen concipi commodè & aptè videbis, & tam commodè: quam in usu baculi tu peripheriâ quadrantis radio, segmento alterius cruris delineatam concipis: aut saltem concipere debes: si calculi veritatem commodè tueri vis & usum instrumenti docere: etenim an non terminus cruris applicandus ad os genæ est? imò. Sed cur? quia scilicet visus ex centro circuli exire debeat. An non hic circulus conceptus? cur non & in quadrante crura baculi mihi concipere liceat? At dices cur

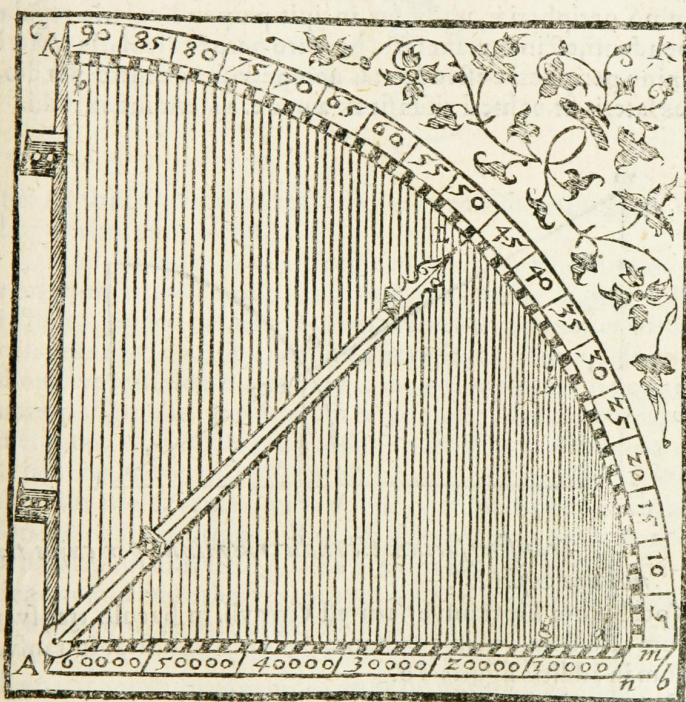
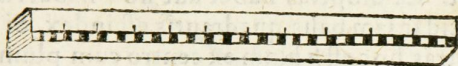
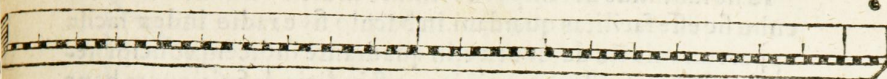
P non

non concipere liceret? sed quemadmodum nec radius circulus dicitur, quia circulus illic concipiatur: sic nec quadrans baculus vocabitur aut radius quia in eo radius concipi possit. Sed heus: si de nomine lis est, voces quadrantem, voces radium: & ego his nominibus usitatis utor. Si de re litigas: audi quid quæram: an non illic circuli centrum concipitur ubi visus exit? imo dices: neque enim negare potes: Ergo si visus exeat à termino peripheriæ quadrantis, quod sæpè fit, ubi jam eo centro descripta peripheria in quadrante apparet. At inquis angulus qui fit à reliquo latere quadrantis & perpendicularo è centro, angulus est quæsitus: bene se jam res habet: id est idem quod ajo. Si visus exeat à termino peripheriæ illic crus est radii unum: alterum est ex centro perpendicularum: angulus à radio optico & crure è dicto centro est angulus quæsitus: hoc est angulus qui fit à latere reliquo & perpendicularo. Ergo ut tandem tibi satisfaciam: Quemadmodum in quadrante si non pro centro usurpetur quod actu centrum est, peripheria quadrantis, ex altero centro, actu non existit: sic radii hoc est quadrantis crura actu adesse semper non est necessum. Sed nimis forsan hac de re: crura doceantur.

3. *Crura radii sunt index & transversarium. quorum terminis dioptræ affixæ sunt.*

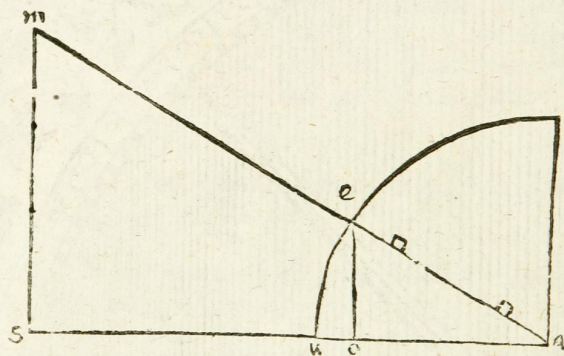
Reperiuntur hodie multi: qui egregiè se & terrena mensos esse & cœlestes descripsisse distantias putant adminiculo radii. interim tamen sine omnibus dioptris visum expaciari sinunt: cum tamen tanta visus sit hallucinatio: ut vix etiam dioptris constringi possit. Est enim ut omnium sensuum celerissimus sic maxime dissipalis. nec enim tantum à centro oculi aut vertice coniotici (cum Euclide enim loquamur) radii excurrunt: sed ut in Sole ab universo corpore. Quare consultum arbitramur visum dioptris constringi: ut in rem tantum metiendam deferri possit. Sed ecce figuram radii.

4. *Index.*



4. Index est radii crus majus, à cuius termino visus est.

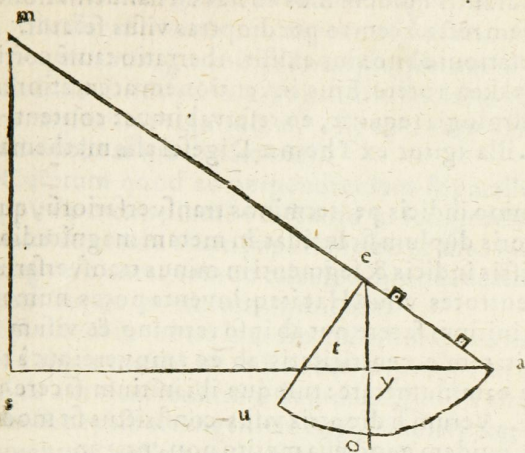
Id sic sumimus ut semper à termino indicis visus sit: Viderur enim sic esse facilitas quædam. in baculo sive radio index facile apparet. nam actu datur ut a e, in quadrante indicem concipi necesse est. Et ut facilius concipias: post indicis definitionem hanc quadrantis fabricam accipe. E' centro, quod actu datur, amulsis sive regula est. Ea dioptras haber aut non haber: si haber per quas visus incidat; jam basis quadrantis est index. Si non haber amulsis dioptras, hoc est si filum ex centro cum plumbea sphaerula dimittatur: erunt in latere quadrantis dioptræ: itaq; recta è termino peripheriæ, ubi visus incipit perpendicularis regulæ dependenti, est index: aut recta è centro perpendicularis rectæ è termino peripheriæ est index: si nempe visus à centro per dioptras lateris sit. ut hic si visus sit ex a per e. a s erit index radii.



4. Transversarium est radii crus minus, per cuius terminum visus est.

Vocabulum hic transversarii est Vitruvii. in baculo transver-
sarium actu daturi o. in quadrante definitio monstrabit transver-
sarium in additis figuris e o.

Cæterum in usu radii utile est multa habere transversaria: par-
tim



tim quę possint imponi ita indici ut ab ea bisecentur partim quę imponantur sine bisectione.

jam vero illud non est artis docere materiam instrumenti. parum enim interest modo solida sit, firma, stabilis, lignea vel metallaris. Sed ut radius ad usum melius accommodes: utrumq; ejus crus certis partibus definias necesse est. Sunt qui indici radius hypotheticum ascribant: sunt qui majorem sunt qui minorem assumunt. Et id parum refert: modo secundum eandem mensuram & index & transversaria particularia dividantur.

jam in usu distantia justa postulatur: nec enim visus est infinitus. Vis optica requiritur in unum oculum diducta: cum unita fortius collimet. tranquillitas & immobilitas instrumenti necessaria est: manus itaq; quietæ sint oportet: secus enim, si trepidet, geodæsiæ turbabitur proportio. Sed & coincidentiam centri oculi cum centro circuli absoluti usus postulat. Secus enim radius opticus cum indice non angulum in centro, sed ad aliud diametri punctum concludet. unde nova existit geodæsię hallucinatio. Summopere itaq; hanc *ἐκκεντρότητα* & visus *παράλλαξιν*

P 3

vitabimus.

vitabimus. Quadrantis quidem usus ab hac est hallucinatione liber: quod in eadem recta è centro per dioptras visus feratur. At radius huic aberrationi obnoxius existit. Aberratio tamè corrigi poterit inventa ekkentrotete. Ejus inventionem accuratiorē, quam forsan Astrologia requirit, eò reservabimus: contenti ea quæ hic sufficit. illa igitur ex Thomæ Digesei alīs mathematicis sic est.

Si visus à termino indicis per terminos transversariorū, quorum majus minoris duplum sic incidat in metam magnitudinis: differentia semissis indicis & segmenti in minus transversarium est dimidia ekkentrotetes visus. Hac itaq; inventa potes numerationis in indice initium facere, aut ab ipso termino & visum secundum quantitatem eccentricitatis ab eo amovere: aut à termino in indice eam numerare: tumque ibi initium facere ubi *index terminus* finit. Verum si dioptris visus constrictus sit modica aberratio in hac quidem geodæsia merito non curatur.

5. *Geodæsia distantie est unius aut duplicis: Geodæsia unius distantie est ubi mensor in metienda magnitudine locum non mutat.*

Hic

6. *Si visus est in metam magnitudinis metiendæ: magnitudo erit tangens anguli indicis atq; radii optici: tumq; index magnitudini rectus est.*

Magnitudinem intelligo lineam aut magnitudinem lineatam in qua lineæ existunt. Verbi gratia si sit metienda latitudo fluvii alicujus: nos lineam consideramus quæ latitudinem mensurat. Quod si jam visus è termino indicis per terminum transversarii cadat in metam ac finem magnitudinis metiendæ: linea quæ metitur magnitudinem erit tangens anguli indicis atq; radii optici: atq; tum index est rectus magnitudini metiendæ: & proinde per 2. e. transversarium erit eidem parallelus. Et in hoc casu suasent: ut tot sint in promptu transversaria particularia ut segmentum indicis semper radius hypotheticus sit, aliquot tamen circulis dextris minutus.

7. *Sin*

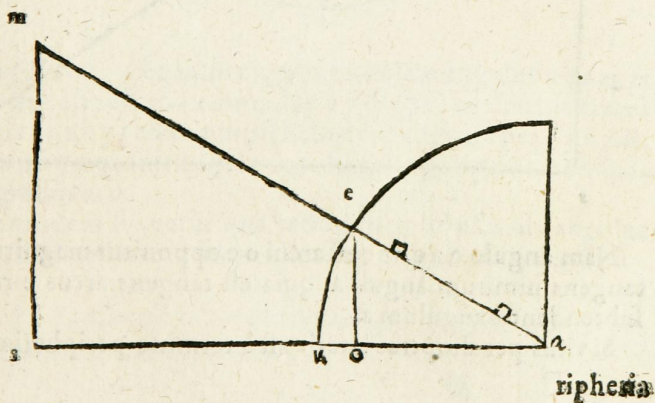
Et hinc rursus per 2. e. concludes indicem tum esse paralle-
lum meriendæ magnitudini. Hic opera erit danda: ut transver-
sarium habeat mensuram radii.

Cæterum quod ad perpendicularum & parallelismum attinet sæpe uti poteris plumbo suspenso in longitudine parallela horizonti: & norma etiam sæpe sufficit: ut usus ipse docebit.

jam vero antequam ad calculum hinc deductum descendam:
anguli hujus inventionem docebo.

Est autem inventio in radio difficilior quam in quadrante: nisi quod supra monui in radio feceris: nempe ut aut segmentum indicis aut transversarium sit radius. Quod si est: jam transversarium illic exhibet tangentem anguli indicis atq; radii optici hic segmentum indicis tangentem anguli transversarii atque radii optici: & quidem in mensura assumpta. Ergo si usus postulet angulus dabitur. Et sic cognosces esse faciliorem usum radii quam quadrantis.

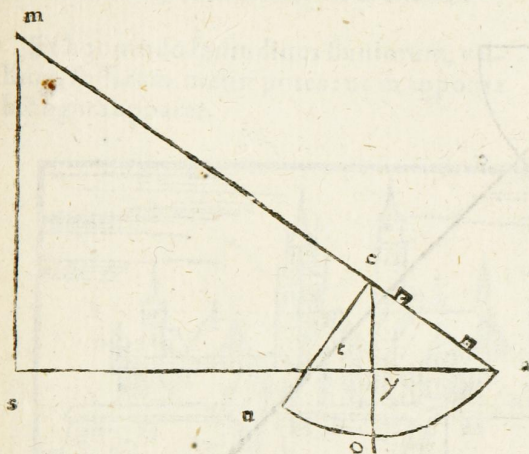
Quod si segmentum indicis non sit radius 6.e. 10. angulos inveniet vel eorum tangentes. in quadrante angulus statim expe-



am magnitudinis oppositæ: angulus oppositæ magnitudinis est peripheria inter latus quadrantis reliquum & filum è centro pendulum.

Est enim visus ab a pere in terminum oppositæ magnitudinis m s. Erit per s e angulus e a s 15 cujus m s est tangens. Eum determinari dico in quadrante arcu u o.

Nam peripheria u o determinat angulum u e y.



At angulus u e y æquatur angulo e a t. Nam angulus u e a ex fabrica rectus est: est etiam angulus e y t rectus ex thesi. præterea triangula e a t, e y t communem habent ad t. Quare per c. 3. e. 7. R. angulus u e y æquatur angulo e a t. Ergo angulus e a t mensuratur peripheria u o.

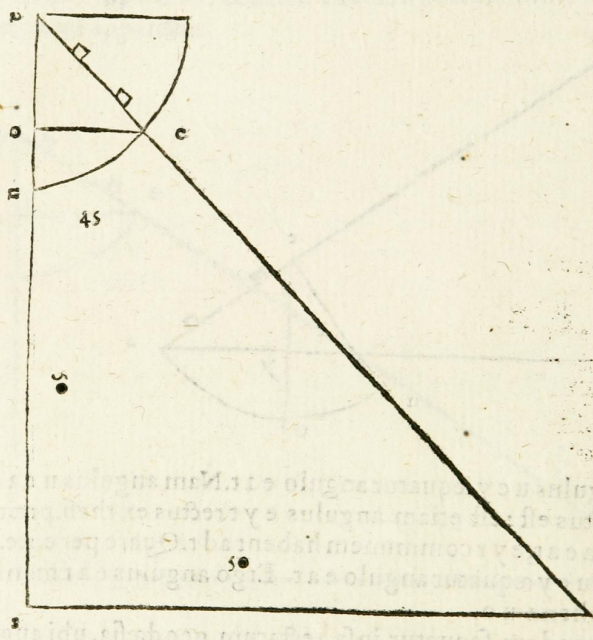
Hinc tandem sequetur ipsa rectarum geodæsia. ubi angulus magnitudinis is erit qui subtrahitur à metienda magnitudine.

Itaq;

3. Radius est ad tangentem anguli longitudinis ut nota altitudo ad longitudinem.

Q Longitu-

Longitudinis inventio hoc elemento docetur: sive jam visus sit in metam magnitudinis metiendae sive magnitudinis ad metiendam rectae ac notae: methodus tamen eadem fuerit. Esto primum visus in metam longitudinis. Sit ergo metienda longitudo s in loco superiore a . & detur altitudo a s pedum 50. Quæritur s m. Capiatur itaq; angulus s a m longitudinis. Sitq; gr. 45. arcus nempe u e aut ei similis è radio a s. Hujus tangens erit 10,000,000.



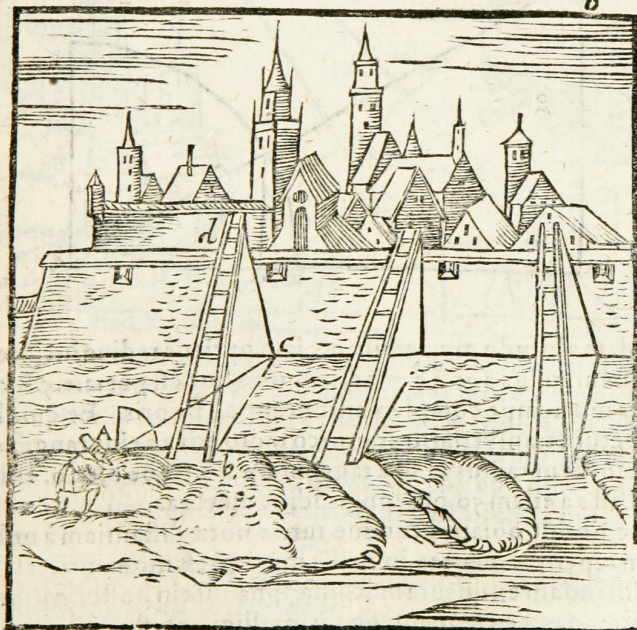
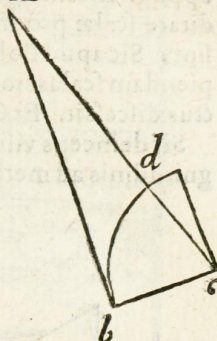
Ergo per 6. e. 10. ut radius ad 10,000,000. sic 50 altitudo ad s m longitudinem etiam 50.

Hinc patet cur facilitas calculi sit si semper segmentum indicis recti sit radius assumptus. Nam per 9. e. 7. R. ut a o ad o e sic a s ad

ad s m, hoc est ut radius ad tangentem anguli a. sic a s ad s m. Quod hic semel repeti-
villē satis sit.

Nec quicquam interest: utrum longitudo sit in subiecto plano, an in ascensu descen-
su' ve montis. modo index rectus sit longi-
tudini metiendæ. ut in sequenti figura pa-
ter: si b a sit superficies montis metiendi.

Et hoc modo latitudines fluuiorum, val-
lium, fossarum metiri potes: ut in apposita
hic figura apparet.

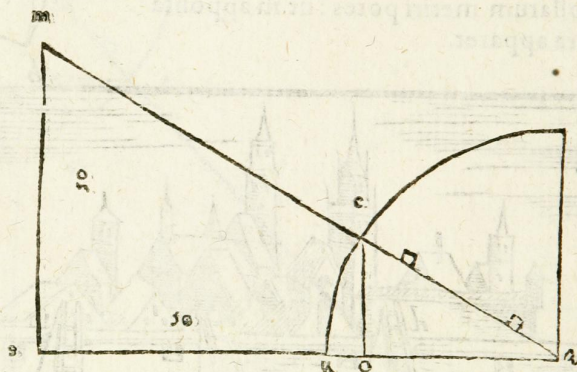


Q 2

Et

Et sane dimensio latitudinis fossarum magni est momenti in oppugnationibus arcis, urbis: ut ex cognita latitudine & profunditate scalæ pro irruptione satis longæ & aptæ fabrefieri possint. Sic apud Polybium Philippus ad Meliteorum urbem capiendam scalas non satis longas attulit. itaq; gravi clade affectus discessit. Et Gallis ad Mediolanū eadē res perinde nocuit.

Sit deinceps visus in metam altitudinis nempe in metam magnitudinis ad metiendam rectæ.& quærenda longitudo a s.

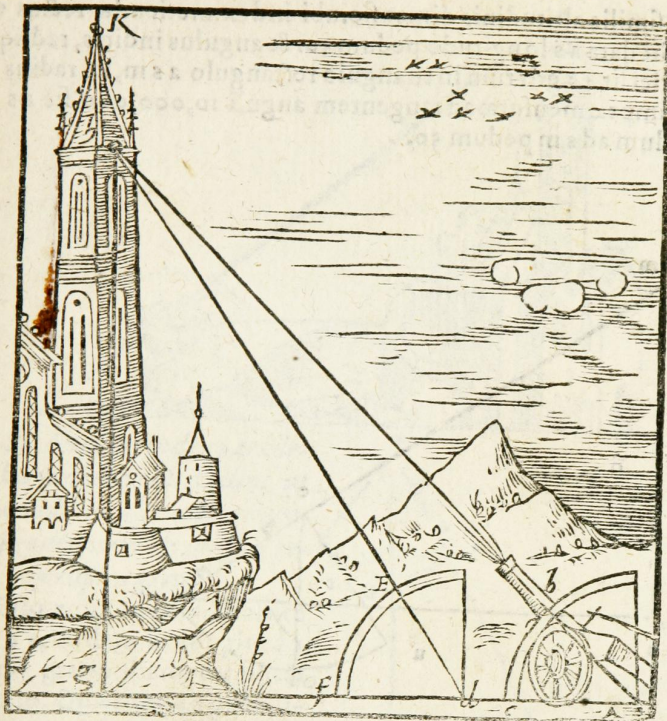


Sit data altitudo m s pedum 50. jam opticus radius incidat in m . sitque angulus a gr. 45. erit etiam o e a hoc est per 12. e. 5. R. angulus s m a nempe complementum anguli prioris. Et quia hic continetur à transversario ac optico radio erit a s ejus tangens. Si itaq; sit ut radius m s ad tangens

Si itaq; fit ut radius $m s$ ad tangentem $a s$ 10,000,000. erit ut $m s$ 50, ad $s a$ etiam 50. pro longitudine quæfitâ.
Hinc licebit oblatâ

Hinc licebit oblatro acumine notæ distantiam à nobis
ad eam reperire: quæ res in bellis maximi est momenti, ut scia-
mus distantiam ex quanta machinæ sphaerula in hostium urbem
firemittenda: ut ex sequenti figura intelligi potest.

Quod



Quod si hic, ut ante indicis segmentum, sic transversarium re-
ctum assumas totidem partium quot radius est definitus: mul-
tum inventionis compendium habebis. Nam per 9. e. 7. R. ut e o
ad o a. sic s m ad s a, hoc est ut radius ad tangentem anguli lon-
gitudinis sic altitudo ad longitudinem. Quod etiā hic de trans-
versario ad magnitudinem metiendam recto semel monuisse
sufficiat.

Et

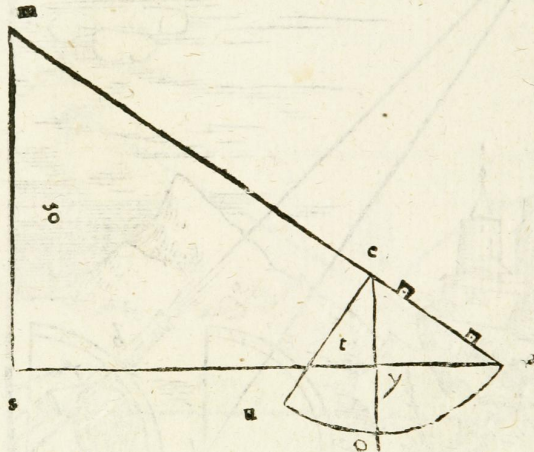
9. Radius est ad tangentem anguli altitudinis, ut da-
ta longitudo ad altitudinem.

Longitudinis geodæsia ex eodem quidem loco fuit: sequi-

Q 3. tur

tur similis altitudinis dimensio. ubi index meriendæ rectus est.

Sit data a s longitudo pedum 50. & angulus indicis, radiique optici sit 45. erit tum in triangulo rectangulo a s m, ut radius a s assumptæ mensuræ ad tangentem anguli 10,000,000 sic a s 50 pedum ad s m pedum 50.

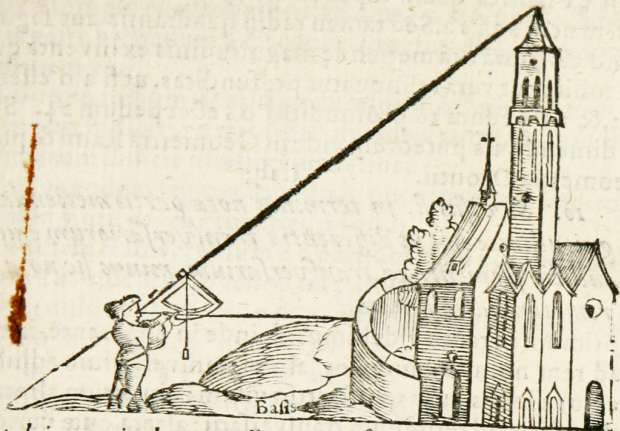


Et hoc modo turrium, ædificiorum aliorumque rerum metri altitudines poteris.

Sed hoc tamen notandum altitudinem eam tantum inveniri quæ est à continuato indice ad verticem altitudinis. Quare men foris altitudo ad inventam altitudinem addenda est:

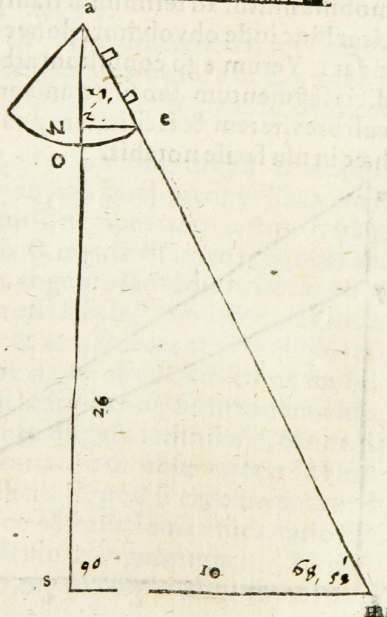
ut si sit data longitudo pedum 250. & segmentum indicis
10,000 tanquam radius, transversariam vero partium totidem
erit altitudo 254. addita scilicet mensores altitudine pedum 4.

Sit



*Sit deinceps index paralle-
lus metienda altitudini. ut
accidit in altitudine ever-
sa puteorum & similiū re-
rum rupis, turris.*

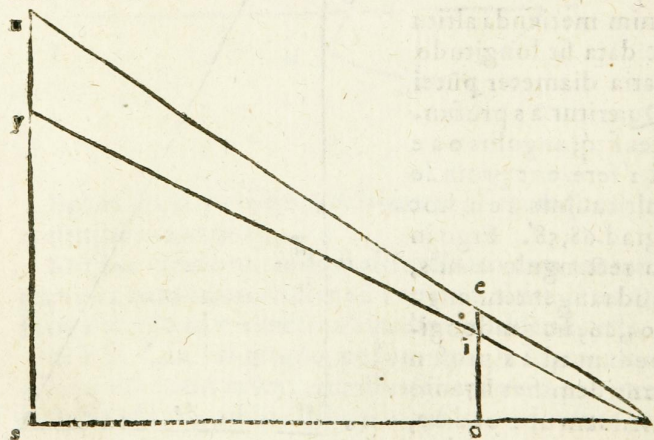
Esto enim metienda altitu-
do $a s$, & data sit longitudo
verbi gratia diameter putei
 $s m$ 10. Quæritur $a s$ profun-
ditas putei. sicq; angulus $o a e$
grad. 21 & 2' ferè. erit proinde
angulus altitudinis $a e u$, hoc
est $a m s$ grad. 68, 58'. Ergo in
triangulo rectangulo $a m s$,
ut radius ad tangentem angu-
li m 26,005,663 sic $s m$ longi-
tudo 10 pedum ad $a s$ profun-
ditatem 26. idem fiet si radio-
uius fueris. Nam ut $u e$ ad $u a$,
hoc



hoc est ex fabrica quam supra præscripsi radius ad tangentem angulum ut m s ad s a. Sed tamen radiū quadrantis aut segmentum indicis supra orā metiendę magnitudinis ex inventa quantitate tollitur ut vera relinquatur profunditas. ut si a o esset pedum 2. & a s pedum 26. profunditas o s esset pedum 24. Schemata dimensionis puteorum vide in Geometria Rami & practica Geometria Orontii. Ita q;

10. Si visus sit in terminos nota partis metiendę magnitudinis: erit ut differentia transversariorum ejusdem indicis segmenti ad transversarium minus sic nota pars remotior ad reliquam.

Id primum in radio videbimus: deinde in quadrante. in radio eam ad rem nonnulli unicum saltem transversarium adhibent, & per ejus pinna duas transmittūt visum: pinnae altera immobilis sistitur ad terminum transversarii: altera quę cursor dicitur hinc inde obvolvitur: donec per utramq; pinnam visus incidat. Verum ego consultum arbitror: ut ad idem quidem indicis segmentum duo sint transversaria: & quidem propter calculi brevitatem & facilitatem paucarum admodum partium. ut hæc in usu facile notabis.



Sic

Sit exempli gratia ædificii alicujus u s altitudo fenestræ in edita parte u y pedum 6. Et cupias hinc investigare reliquam altitudinem y s.

Admove radium & mitte visum primò in u erit tum a o segmentum indicis: e o transversarium seu tangens anguli e a o si segmentum indicis intelligatur radius.

Rursus eodem segmento indicis per transversarium 10 mitte visum in y. erit 10 tangens anguli i a o.

Sit autem transversarium e o partium 12, i o partium 10. Erit ergo ut 2 ad 10, sic 6 ad 30 reliquam partem.

Nam quia e i & u y, ite i o & y s sunt parallelæ erit per 14. e. 5. R.

ut e i ad u y sic i a ad a y

ut i a ad a y sic i o ad y s.

Ergo per æquationem rationum & alterne.

ut e i ad i o sic u y ad y s.

Eadem ratio in quadrante est: Nam differentia transversariorum, ut patuit, est differentia tangentium e a o, i a o. Ergo ut hæc differentia ad tangentem minorem sic nota pars ad reliquam. Quod monuisse satis sit.

Et sic geodæsia unius distantiae fuit longitudinis & altitudinis: cur etiam non latitudinis? an non fieri poterit ut linea transversa unica statione mensureretur? si nempe index rectus sit transversæ ad terminum latitudinis: & regula visum in reliquum terminum deducat: an non jam angulus latitudinis notus est: & proinde ejus tangens? verum est: si sit instrumentum, latitudini rectum, parallelum horizonti: & tum si detur tertius aliquis terminus datur latitudo: quæ tamen tum aliud nihil est quam longitudo vel altitudo. Quod si latitudo non sit in eadem altitudine cum mensore: certe invento angulo latitudinis, & non dato termino tertio nempe distantia à loco observatoris in latitudinem unica distantia non sufficit. Quod si ergo inventa sit distantia illa in latitudinem à loco observationis unica statio sufficiet. inventio autem erit ex calculo triangulorum. Nam

ut radius ad tangentem anguli longitudinis aut altitudinis,

R nis,

si fit 10,000. i.e 5,774. Ergo ut 10,000. ad 5,774 sic $70\frac{2}{3}$ ad $40\frac{4}{5}$.
Quod ante monui.

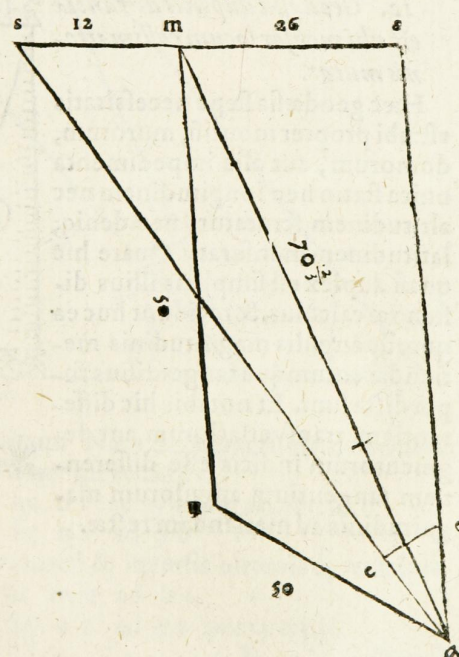
Sic jam index perpendicularis latitudini ad aliud punctum.
tam particulares latitudines restituent totam. Erit autem per-
pendicularis ad medium aut extra. Si ad medium jam via patefa-
cta est. Nam latitudo dicto modo inventa si duplicet, est quæ sita.

Experimentum autem facies: si imponas transversariū quod
ab indice bifecetur: & tum visus immoto radio sit in utramque
metam latitudinis. Tum enim angulus indicis radiique optici
unius, est angulus semissis latitudinis. Sed quia laboriosa est &
molesta inventio istius puncti bisectionis imo nec semper de-
tur accessus ejusmodi: ut index in medium punctum latitudini
sit perpendicularis: utile est à quocunque puncto latitudinis se-
gmenta mensurari: pri-

mo primū secundò se-
cundum. At quomodo
idem punctum notabo
verbi gratia in pariete
dealbato: id facile erit
signo aliquo cōcepto,
aut facta collimatione
secūdm signa duo in
loco menforis conce-
pta: manum admove
& facile videbis.

Sic in sequenti sche-
mate ex eadem distan-
tia cape m s latitudinis
dextræ angulum m a e
verbi gratia 20. Sicque
eadem distantia quæ
ante fuit nempe m a pe-
dum $70\frac{2}{3}$. & ex cano-
ne datur tangens g. 20.

R 2 nempe



Ducatur perpendicularis rectæ mr . ipsa ny quæ fecerit ty æqualem ipsi or ut y sit differentia segmentorum indicis: hoc est differentia tangentium complementorum quæ sitæ altitudinis angulorum.

jam reliqua sic erunt.

ut at ad as sic te hoc est oe ad ms .

ut oe ad ms sic or hoc est ty ad rs . Quare ut totus at ad as sic ablati ty ad rs ablatum: erit ergo ut totus ad totum sic reliquus y ad reliquum ar , hoc est ut oe ad ms .

Quod si transversarium sit 9 , & distantia stationum pedum 30 . indicis segmentum minus 9 . majus 12 . erit altitudo quæ sita pedum 90 .
Nam

3. 9. 30. 90.

in quadrante res eadem est: est enim ut differentia tangentium complementorum angulorum altitudinis ad minorem sic distantia ad altitudinem.

Est enim angulus primæ collimationis e t gr. $36,52'$. erit angulus te a gr. $53,8'$. Ejusq; tangens or vel ty $1,333$ resectis scilicet dextris notis quatuor. Et angulus secundæ collimationis e o sit gr. 45 erit & angulus longitudinis totidē ejusq; tangens $1,000$. Quare ty de t a relinquet y a nempe $1,000$ de $1,333$ relinquit 333 jam distantia stationum ar sit pedum 30 . altitudo erit 90 .

333 ad $1,000$. sic 30 ad 90 .

Ramus ex superioribus multa hinc deducit postulata ad 12 . c. 9. primo de differentia duarum altitudinum: ex dimensionum nempe subtractione.

Secundo: ex inæqualium altitudinum exempli gratia turrium altera licet alterius altitudinem metiri, quod etiam hinc expeditum est: primo enim si ex minori velis metiri majorem cape per 8 e longitudinem inter minorem & majorem. tum enim 9 e dabit altitudinem supra minorem quæ cum nota minore addita restituit majorem.

Secundo si è majore velis metiri minorem: rursus è nota majori altitudine capies longitudinem inter altitudines: tum 9 e dabit

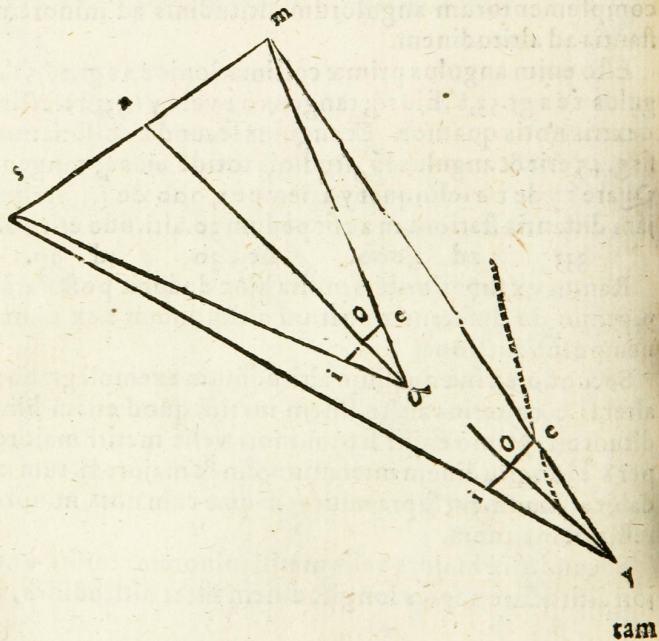
dabit altitudinem qua major superat minorem inde reliqua pars
de maiore est altitudo minor. Schema illic Rami additum huc
referri poterit.

Tertium ipsi postulatū est de inventionē distantiae turrium
 ē vertice alterius: quod in præmissis innotuit postulatis per 8. c.
 Figura Rami huc etiam accommodari debet.

Ec

15. Si visus sit in termino latitudinis per idem transversarium: erit ut indice differentia ad differentiam stationum, sic transversarium ad latitudinem.

Hic rursus, ut in superiori latitudinis dimensione, index perpendicularis latitudini, est ad terminū ejus perpendicularis aut ad aliud punctum: & tum summa particularium latitudinum to-



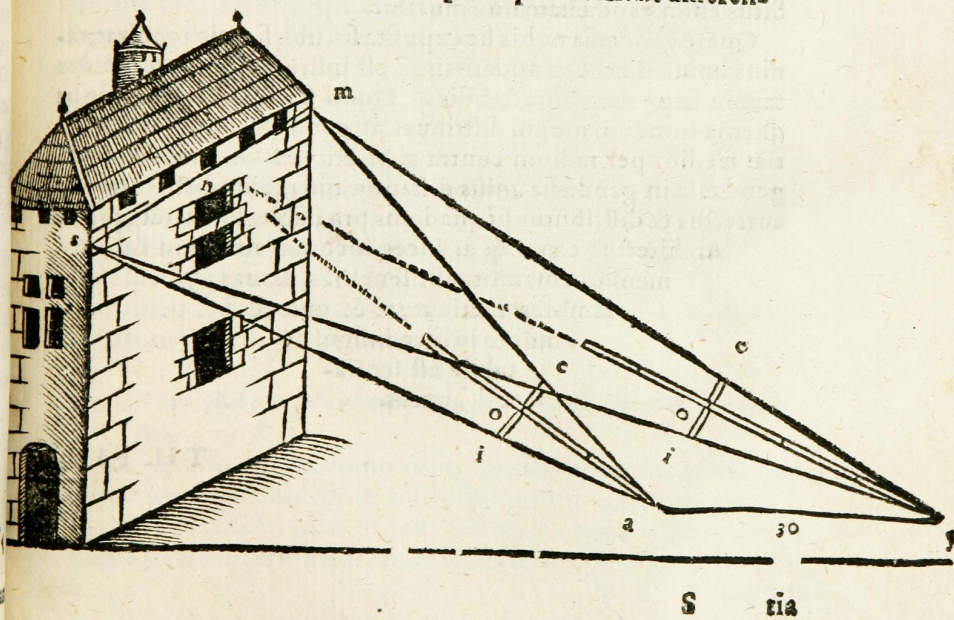
tam colligit. Sed tamen expeditior ratio est, si transversarium im-
ponatur ita ut in metiendæ latitudinis terminos immoto radio
visus deferatur. ut sit metienda latitudo s m.

jam sit prima collimatio ex a per e in m indice perpendiculari
ad punctum m: & ex a manente indice per i visus diducatur in s.
Quod si non sit in promptu unum transversarium tale: imponan-
tur sane duo, sed ita ut idem in eodem stationis loco secent in-
dicis segmentum.

Secunda collimatio sit ex a manente transversario e i sim-
plici aut duplicato. sed longius tamen ab oculo remoto: & sit
visus pere & i in m & s.

Dico esse ut indicum differentiam nempe differentiam a o &
y o ad y a sic transversarium e i ad s m latitudinem.

Demonstratio cum priori eadem est. Nam ducta parallela ad
a m quæ secet ex o y segmentum æquale ipsi o a: erit ut differen-



tia segmentorum indicis ad y a sic e o ad $m n$. & i o ad $n s$: ut ante patuit: Ergo per terminorum proportionalium additionem, erit ut differentia segmentorum indicis ad y a sic i e ad $s m$.

Sic si sit metienda latitudo domus $s m$, & sit a o 12. $y o$ vero 20. transversarium i e 6. ita ut ab utraq; indicis parte 3 sint.

Sitque distantia collimationis a y pedum 30. Quæritur $s m$. Differentia segmentorum indicis est partium 8. Ergo $s m$ erit pedum $22\frac{1}{2}$.

Nam

8.

6.

30.

$22\frac{1}{2}$.

Quod in particularium quoque latitudinum dimensione sic patet: ut se haber 8 ad 3, sic 30 ad $11\frac{1}{2}$ pro $n m$ itemque pro $s n$. Nam transversarii segmenta utrinque æquantur.

Et hinc intelligitur quomodo quadrante capienda sit. Nam ex antecedenti datur primo $n m$, deinde $n s$ tanquam altitudines: hinc summa $m s$. Et idem fuerit si visus sit in superiori loco. Situs enim geodæsiæ non mutabit.

Quare geodæsiæ nobis sic exposita sit. ubi, si quis requirat, radius quidem accommodatissimum est instrumentum: quadrans tamen sæpè magis tractabilis. Quod si radio uti vis: vide ut quemadmodum monui distribuas. in geodæsiâ duplicis distantiae facilior per radium contra aberrationes visus munitum est geodæsiâ. in geodæsiâ unius distantiae nisi radius dicto modo & correctus & distributus sit quadrans præstabit. Hinc itaque pictor

Architectus cæteri que artifices locorum omnium dimensionem instituent: fenestras, statuas pyramides metientur: & quicquid omnino in loco insigni notabile est scrutabuntur.

T H. F I N.

TH. FINKII GEOMETRIAE ROTVNDI,

LIBER DVODECIMVS.

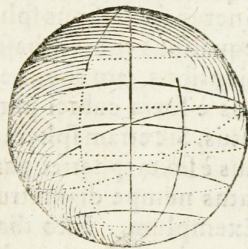
De sphæra eiusq; circulis.



Rotundi nobis Geometria est proposita: ejus duo fecimus genera circulum & sphæram. Circularem itaque Geometriam sphærica sequetur quam brevissime delineata.

1. Sphæra est rotundum solidum.

Posset definiri corpus comprehensum à sphærico seu superficie sphærica: verum rotundum dici rotundius est. Vulgo corpus sphæricum, Latine globus dicitur: sed tamen sphærae vocabulum græcum retentum in usu est.



Proclus in hypotyposi astronomiarum hypotheseon duplicem sphæram facit. Alia enim ipsi *septa* est alia *agnotis*, hoc est armillaris, distinctis circulis conspicua: cujusmodi est ea quam Elementarii Astrologi in Sphæricis suis libellis explicant. Sed hæc divisio seu distinctio non usq; adeo est necessaria. Nam armillaris est tantum effigies certarum sphærae partium.

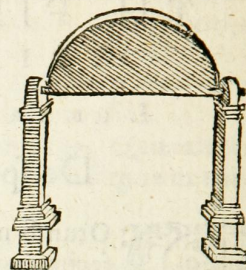
Itaq;

2. Sphæra fit conversione semicirculi, manente diametro. 14. d. 11.

Sic peripheria generatur motu puncti lineæ unius reliquo quiescente: circulus motu lineæ quiescente ejus termino uno. Sic conus Euclidi 18. d. 11. fit conversione trianguli rectanguli manente altero crure. Sic 21. d. 11. è rectangulo cylinder fit, & sic de-

S 2 incept;

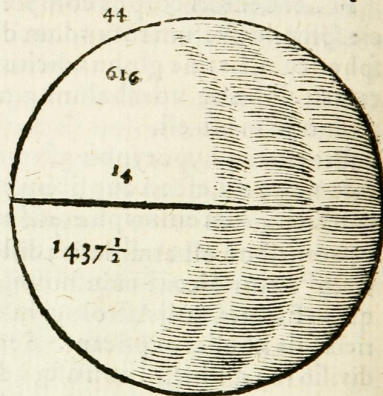
inceps: & hoc modo sphaera fit conversione semicirculi manere ejus basi nempe diametro. nimirum si concipiamus spaciū illud quod in conversione semicirculus attingit solidari & quasi corporari. id quod in officinis tornariorum videre licet. ibi enim corpus circa polos & axem motum, spaciū rotundat.



3. *Planus est diametro & sextante sphaerici est sphaera.*

Sphaericum metieris per 5. e. 20. R. Hic ut circulo & sphaerico, sic cūlo & sphaerae sua est analogia. Cubicum seu cubica superficies comprehenditur sex basibus quadratis & proinde aequalibus. Sphaera item continetur sex basibus sphaericis aequalibus cubicas bases ambientibus. jam cubus est planus est sexta cubici parte per latus. Sic etiam sphaera est planus est sexta sphaerici parte per latus nempe diametrum.

Exemplum. Est diameter seu axis sphaerae 14. hoc est diameter maximi circuli. jam per 1 e 8. peripheria maximi hujus circuli est 44. Ergo planus est 44 per 14 nempe 616 est sphaericum per 5. e. 20. R. Nunc planus est $\frac{616}{6}$ per 14, hoc est $1,437\frac{1}{3}$, est ipsa sphaerae soliditas.



Itaq; ad diametrum descriptis

4. *ut 21 ad 11, sic cubus diametri ad sphaeram.*

ut in praesenti exemplo cubus axis est 2,744. Nam 14 per 14 facit 196 & haec per 14 faciunt 2,744 cubum scilicet diametri. jam

jam ratio 2,744 ad sphæram 1,437 $\frac{1}{2}$ est in minimis terminis ut 21 ad 11. Maxima enim communis mensura 8,232 & 4,312 integrorum datis proportionalium est 392. per quam divisi redeunt ad 21 & 11.

Et

5. Planus est sextante sphericæ & radio est hemisphærium. ut planus est $\frac{6}{7}$ & 7 est 718 $\frac{2}{3}$. Sed accuratius est sumere dimidiam sphæram.

6. Sphæra sunt ut à diametris cubi. 18. p. 12. caparitate.

Solida similia habent triplicatam rationem homologorum laterum 5. e. 20. R. & axes sphærarum sunt earum latera homologa: rursus cubare (ut ita diaam) diametros est triplicare rationem homologorum laterum. Ergo ut cubi diametrorum sic sphærae. Euclidea demonstratio paulo est laboriosior. Exempla fructus hujus propositionis apud Astrologos multa reperiuntur.

Stellas primi luminis atq; honoris ita ad terræ globum se habere ajunt: ut sit ratio diametri earum ad diametrum sphærae terræ quadrupla major tribus quartis qualis est 19 ad 4. Hinc inquiritur differentia magnitudinis stellarum earum & terræ: & inveniuntur eæ ad terram ut 6,859 ad 64. nempe si cubicè terminà multiplicentur.

19	4
19	4
361	16
19	4
6,859	64

Hoc est terram superari à stellis illis magnitudine & crassitie centies septies & $\frac{1}{6}$ $\frac{1}{4}$.

Sic Ptolemæus deprehendit Solis diametrum ad globi terreni axim esse ut 11 ad 2. Ergo ex cubica multiplicatione Sol est ad terram ut 1,331 ad 8.

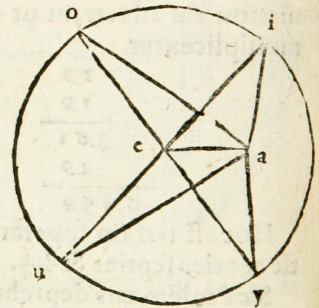
11	2
11	2
121	4
11	2
1,331	8

S 3 Ergo

Ergo Sol terram superat centies sexagies sexies & $\frac{3}{8}$. Copernicus noster paulo maiorem invenit diametrum. Deprehendit enim ~~ex~~ ~~contra~~ solarem à tempore Ptolemæi decrevisse. itaque ex opticis diametrum auctam esse. ut hæc in Astronomicis docentur.

Atq; hæc ferè sunt quæ apud Euclidem atq; Ramum habemus de sphaera sigillarim. Nos ex Regiomontano quædam addemus: post calculum novum exponemus. Hoc tamen admonitum Lectorem Philomathen volo: ut sibi sphaeram compareret distinctam circulis; qualis esse potest quo vulgo ab Astronomis decem circulis componitur. in ea enim sequentia melius videri possunt quam in charta ac superficie depingi.

p centro sphaerae Si axis sphaerae est per centrum circuli: est perpendicularis recta perpendicularis rectis laris dicto circulo: & contra. 2.1.p.3. Regiom.
in plano intersectis Regiomontanus segmentum tantum axis adhibet: quod eodem redit. Nam segmentum axis in axem continuari potest.
ipsi plano perpendiculari Est itaq; centrum sphaerae a. circulus sphaerae i o u y. eiusque
p. 3. e. 21. R. Axis d e centrum e. jam recta sit ab a in e, hoc
p perpendicularis diamet est axis aut segmentum ejus.
tr's o y in sphaera Dico a e esse perpendicularem circulo i o u y. Ducantur enim circuli
o e a a e y anguli de diametri i u & o y earumq; termini
ceps inter se aequales conneantur cum centro sphaerae re-
Ideog. 7. e. 2. R. rect ctis a o, a u, a y, a i, quæ sunt sphaerae
Ergo axis a e e ppe radii & proinde per 2. e. 1. æquales.
similari ipsi circulo Sed & radii e u, e o, e i, e y sunt æqua-
prob: m. n. 9. o e a, a e y les: & a e latus commune est. Cum
ang: aequat. triang: o a e itaq; triangula hæc sint æquilatera,
æglatera st ægungula perunt æquiangula per 1. p. 7. R. & an-
1. e. 7. R. triang: o a e guli ad e æquales.
a e y st æglatera st Quare cum a e diametris circuli rectè interjaceat per 10. e. 2. R.
o e e y st radii circuli erit iis perpendicularis in communi diametrorum sectione
o a & a y st radii nempe ad centrum.
sphaerae a e e latus At si recta est rectis in subiecto plano intersectis perpendicu-
lari laris



laris in communi sectione: est perpendicularis subiecto plano per 3.e.21.R.

Quare a e axis est perpendicularis circulo i o y.

Conversa pater: Nam si axis perpendicularis circulo non est per centrum: erit extra.

At si extra centrum sit: jam recta duplex ex eodem termino nempe centro sphaerae erit perpendicularis eidem plano.

At perpendicularis ab eodem termino & eadem parte non est duplex per c.10.e.2.R.

Ergo perpendicularis axis in circulum non est extra ejus centrum

Itaq;

8. Perpendicularis e centro circuli utringq; in sphaericum continuata est axis sphaerae. 3.p.3.Regiom.

Demonstratio est Regiomontano per absurdum. ut e centro circuli e egrediatur perpendicularis e a: in sphaerae centrum cader: hoc est continuata erit axis sphaerae. Si enim non est axis. jam e centro egreditur duplex perpendicularis: haec recta continuata ex thesi: deinde axis alius ex thesi ad versarii. At id fieri nequit: ut jam ante patuit.

9. Axis sphaerae est etiam axis circuli, cui ille est perpendicularis.

Id vulgo sic sumitur: unde & poli sphaerae sunt poli circuli eodem modo. Hinc ex premissis elementis sunt 4,5,6,7,8,9.p.3.Regiomontani. quas huc referes.

Prob: A quocumq; sphaerici puncto recta perpendicularis circulo p centrum sphaerae ducitur. hnt e axis

Itaq; i polus dati circuli p 7 e. At a puncto

10. Si sphaerici punctum est terminus rectarum trium a quo tres rectae in peripheriam circuli aequalium: est circuli dicti polus. quales in p-peripheria

13.p.3.Regiom. duci possunt, ut quae recta perpendicularis

Hoc respondet circulo ad 27.e.1. polus datus circuli. 80. hnt puncto e

A puncto enim sphaerici a. in peripheriam o u i sint aequales minor pbo: q; ut

rectae tres. a jo circuli dicti polum esse in a. Etenim ab a in circulo transeat recta a di-

lun dimittatur perpendicularis a y. Erunt ergo anguli ad ycto puncto circuli

Polus axis sphaerae, plano circuli recta perpendicularis. Si pnt

perpendicularis e, quae pnt in p-peripheriam ducit a y centrum circuli 27 e.

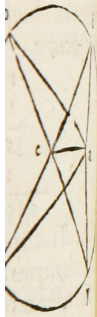
At puncto in q perpendicularis a y linet e terminus o y, ya, y n aequalis. Et n ex

thesi. a o a i an aequales sint, ear e q ita a

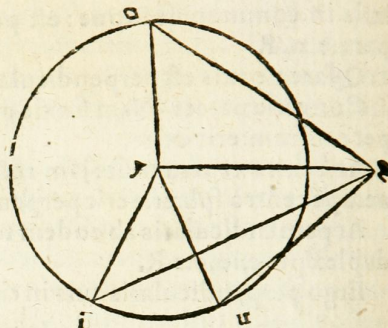
quabnt. ideo si a qm lib; ito auferat titum ay

reliqua ita erunt aequalia q p ea ipa qd

recta aequalit. 80 puncto y erit dicti circuli



recti, Et cum ay sit commune
 latus & ao , ai , au ex thesi
 æquantur: per 5. e. 12. R. oy ,
 yi , yu æquantur: & per 27
 e. y est centrū circuli. Quare
 ex superioribus y a axis sphæ
 ræ est axis circuli, cui est per
 pendicularis ex thesi. ideo
 ejus terminus a est polus ut
 sphæ ræ sic circuli oui .



Et

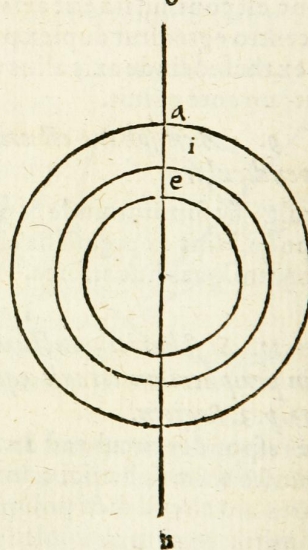
11. *Circuli quorum axis communis est sunt paralleli.*
 22.p.3. *Regiom.*

Nam cum ex thesi axis communis sit: erit per centrum circu
 lorū ipsis perpendicularis per
 9 & 7 e.

jam vero si plana communi
 perpendiculo dividuntur per
 12. e. 21. R. sunt parallela. ut hic
 circuli a, i, e . habent axem com
 munē ou . Ergo sunt paralleli.

Exemplum sumere potes in
 sphæra astrologica ex Æqua
 tore & tropicis: his enim com
 munis axis est. unde & paral
 leli sunt.

jam contra si sint paralleli
 per 12. e. 21. R. communi per
 pendiculo dividuntur. Id con
 tinuatum utrinq; incidit in po
 los circulorum communes.



12. *Maximus*

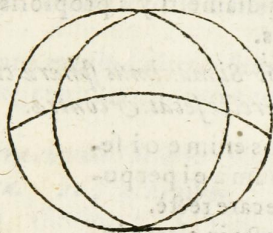
12. *Maximus sphaerae circulus est qui sphaeram bifecat.*

Id Euclides seu Euclidis demonstrator ad demonstrationem 17.p.12. sic postulat: nempe circulum maximum esse eum qui per sphaerae centrum sphaeram fecet: hoc est qui sphaeram bifecet.

Itaq;

13. *Circuli maximi se bifecant. 19.p.3. Region.*

Nam axis sphaerae est ipsorum communis sectio & utriusque communis diameter. Secant enim sphaeram per centrum. jam diameter eadem secat ex aequalibus equalia segmenta, nepe semicirculos per 2. e. 4.



Et

14. *Circuli equidistantes à maximo, sunt aequales. 28.p.3. Region.*

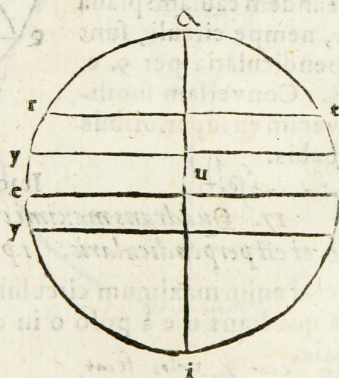
Et

15. *Propior maximo, est major remotiore.*

Causa eadem est ex 7 & 25. e. 1. Nam circuli sunt ut à diametris quadrata: Et diametrorum aequalium, inaequalium quadrata sunt aequalia, inaequalia per 1. c. 2. e. 12. R. Et rursus circulorum equidistantium à maximo diametri sunt aequales: propioris diameter major est quàm remotioris. Quod hinc patet.

Ducatur circulus magnus secans aequidistantes à maximo item remotiores & propiores per polos.

Sitq; communis sectio maxi



mi cum descripto maximo recta e o. diameter nempe utriusque
sectio vero communis descripti cum æquidistantibus à maximo
duæ rectæ y s & y s. cum propiore itidem y s cum remotiore r t.
Dico y s, y s æquari. Nam per thesin æquidistant à centro. Ergo
per 24 e i. sunt æquales.

Rursus y s major est quam r t per 25 e i. itaque circuli quorum
diametri sunt y s nempe æquidistantes à maximo sunt æquales:
& circulus diametri y s propioris est major circulo diametri r t
remotioris.

si secans p polos transeat:

in sphaera lamellari col. 16. Si maximus sphaerae circulus maximum per polos sit.

in intersectant æquidistantes

q p illic polos transeat

Dico angulos a col. 16. Si maximus sphaerae circulus maximum per polos sit.

q æquidistantes factos

esse rectos. Nam

linea recta in plano

intersecante e ppen

dicularis plano inter

secto, plana ipsa

sunt p perpendiculari

ge. 21. k. At si max

imos secat, diamet

ter, q p secti cir

culi polos transeat

e p perpendiculari

circulo intersecto

(Diameter enim ista

fit circuli intersecti

axis, cui p polos e

transeat ideo q p

g. e. hinc e plano circuli intersecti

p perpendiculari. Ergo si

maximo circuli max

imos secat, ipsi in

ter se p ppendi

lantes. Conversa:

si maximo circuli max

imos secat, ipsi in

ter se p ppendi

lantes. Conversa:

si maximo circuli max

imos secat, ipsi in

ter se p ppendi

lantes. Conversa:

si maximo circuli max

imos secat, ipsi in

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si maximo circuli max

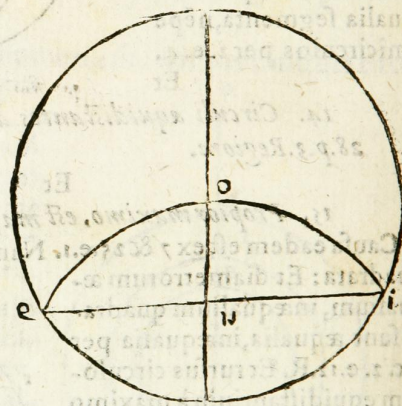
Si maximus sphaerae circulus maximum per polos sit. recte secat. & contra. 20. p. 3. Regiom.

Maximus enim e o i se-
cet maximum a e i per po-
los. dico secare recte.

Nam si recta in altero in-
tersectorum planorū per-
pendicularis reliquo, ut
hic à polo in centrum re-
cta o u perpendicularis cir-
culo a e i, est perpendicu-
laris communi sectioni e i

per eandem causam: plana
ipsa, nempe circuli, sunt
perpendicularia per 9. e.

21. R. Conversam simili-
ter veram ex superioribus
probabis.



Itaq; 17. Quadrans maximi circuli à polo maximi in ipsum,
ei est perpendicularis. 1. p. 4. Regiom.

Secat enim maximum circulum per polos. ut in præmissa fi-
gura quadrans o e à polo o in circulum a e y ei est perpendi-
cularis.

Et

si maximo circuli max

imos secat, ipsi in

ter se p ppendi

lantes. Conversa:

si maximo circuli max

imos secat, ipsi in

ter se p ppendi

lantes. Conversa:

si maximo circuli max

imos secat, ipsi in

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imos secat, ipsi in

ter se p ppendi

lantes. Conversa:

si maximo circuli max

imos secat, ipsi in

Et

18. Si quadrantes maximorum circularum perpendiculares maximo circulo concurrant: punctum concursus in sphaerico est polus dicti circuli. 2. p. 4. Reg.

Est in præmissa figura quadrantes e o, i o perpendiculares ad circulum a e i concurrant ad punctum sphaerici o. dico ibi esse polum circuli a e i.

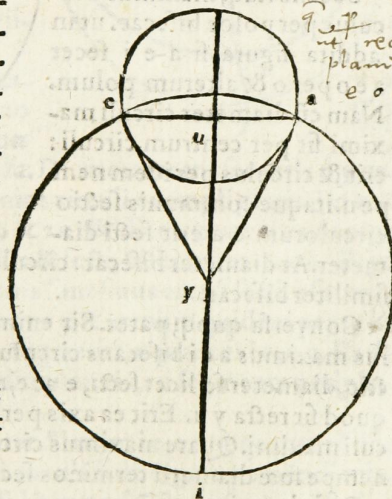
Nam maximus circulus maximum rectè secans, secat per polos. 18. e.

At ex thesi sigillatim quadrans maximi circuli secat rectè maximum. Ergo sigillatim secat per polum. hoc est concurrunt in polo maximi circuli.

19. Si maximus sphaerae circulus bisecet minorem circulum: rectè secat: & contra. 21. p. 3. Regiom.

ut hic si maximus circulus a e i bisecet circulum a o e: rectè eum secat: Nam cum bisecet per centrum secat. copuletur itaq; centrum u cum centro sphaerae y. erit axis y u perpendicularis circulo a o e per 7 e. Ergo per 10. e. 21. R. circulus per axem secans secto circulo est perpendicularis.

Conversa, Si rectè secat bisecat, patet. Secat enim per centrum. Esto enim communis sectio e a. jam sit perpendicularis y u à centro sphaerae in cõmunem sectionem: hoc est recta à centro sphaerae bisecet communem sectionem. erit ergo u ipsum circuli centrum & e a ejus diameter. quæ cum



T 2 bisecet

Recta in: y u e perpendicularis axi e o a p
7 e. cum sit polum sphaerae & axi e o a p
Ora igitur plana
est y u ita facient
ut recta tota sit in iis
planis perpendicularia
e o a circulo eunt.

bifecet circulum: & circulus secans sit per diametrum: circulus secans similiter bifecabit.

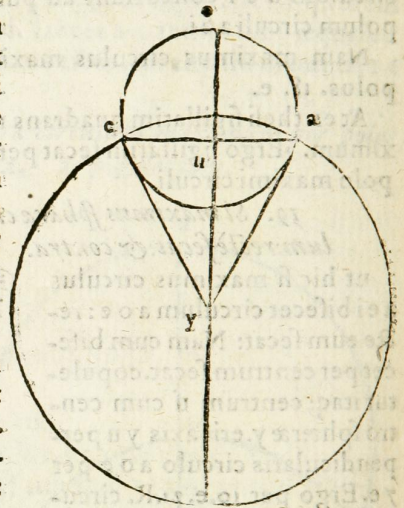
20. Si maximus sphaerae circulus, circulum minorem per polos secet: bifecat: & contra. 16, 17, 18 p. 3. Regioni.

Circulus maximus per unum polum secans, non potest non etiam reliquum secare. Nam circuli maximi diameter est axis sphaerae: quare si per unum axis polum sit tanquam suae diametri terminum, erit & per reliquum. Quare sectionem per polos dicimus: cum non possit maximus circulus per unum secans per reliquum non secare.

Secans itaque maximus circulus per polos bifecat. ut in addita figura si a & i secet a & o per o & alterum polum. Nam cum diameter circuli maximi sit per centrum circuli: erit & circulus per idem nempe u . itaque communis sectio circulorum e & a erit secti diameter. At diameter bifecat: circulus ergo per diametrum secans similiter bifecat.

Si max. circuli max. de Conuersa quoque patet. Sit enim in praemisso schemate circulus maximus a & i bifecans circulum o & e . Sitque communis sectio, diameter scilicet secti, e & a : ejus medium est centrum u . per quod sit recta y & u . Erit ea axis per 9 & 7 : ea axis est diameter circuli maximi. Quare maximus circulus bifecans etiam per polos nempe suae diametri terminos secabit.

Et sic habuimus sectionem circuli majoris, circuli minoris per maiorem:



majo rem: sequitur jam sectio circularum per majorem: & primo intersectorum.

21. Si maximus sphaera circulus, circulus intersectos per polos intersectorum secet: segmenta peripheriarum utring. sese intersecant, hos à secante in reliquum sectum sigillatim sunt aequalia: Contra fedus secas contra. 26.p.3.Region.

Sint enim inter se di duo: quo-
rum poli sint a & e. per hos se-
cet circulus magnus o a e y.
Dico segmenta cujusq; à secan-
te in reliquū utrinq; sibi æquari
nempe o i. ou & i r, r u. Sic in al-
tero si, su & i y, y u.

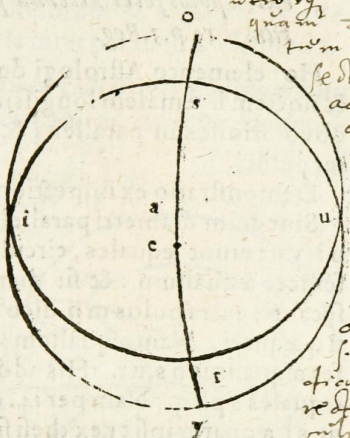
Nam circulus tertius secans,
secat ex thesi per polos. Ergo si-
gillatim utrumque bifecat per
20. aut 13 e. Quare utrinq; sigil-
latim est semiperipheria.

Reliqua dehinc demonstra-
tio sic concipienda est in uno
intersectorum circularum: quæ
etiam de altero est intelligenda. Diameter tertii secantis o y. ca-
det per prædicta in polos unius circuli exempli gratia i o u r. Quare est per centrum per 9 & 7 e: & diametrum ejus, nempe
communem sectionem secantis & secti, bisecat per 19. e i. Ergo
bisegetur communis sectionis sunt sinus arcuū secti, à secante
utrinq; in reliquum sectum per 7 e 5: & arcuum quidem per 15 e s
æqualium. atq; sic duo utrinq; segmenta æquantur i o, o u. Ea de
semiperipheriis æqualibus relinquunt i r, r u segmenta periphe-
riarum æqualia.

Conversa eodem modo patet. Si enim io, ou æquantur sinus
eorum æquantur nempe radii circuli secti. Quare perpendicu-
laris è puncto bisectionis hoc est è centro secti continuata est dia-

T 3

meten



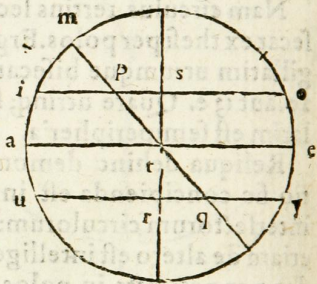
meter maximi circuli per 8 e. quæ cōtinet polos sectorum. Quare tertius secans transieris per suæ diametri terminos transit etiam per polos intersectorum. Sed hæc, ut dixi, in solida figura & globo ipso plenius videntur & cognoscuntur, quam in charta depinguntur.

22. Si maximus sphaera circulus parallelus & æquales extra polos secet: alterna peripheriarum segmenta æquantur. 19.p.3.Reg.

Hoc elemento Astrologi docent diem æstivum longissimum & noctem hyemalem longissimam æquari. Et cæteras stellarum obvolutiones in parallelis & æqualibus cœli partibus similiter perfici.

Demonstratio ex inspectione globi non est obscura.

Sint enim diametri parallelorum o i, y u: erunt æquales, circulorum scilicet æqualium: & sit diameter secantis extra polos m n. dico o p & u q æquari. Nam æqualium semissemis æquantur o s, u r. His addantur æquales s p, r q. Nam per 14. e. 5. R. ut s t æquatur ipsi t r ex thesi sic s p, r q. sibi æquabuntur. Summæ ergo erunt æquales.



Hinc secundo sequitur quod erat propositum. Sinuum secundorum æqualium æquales sinus primi sunt. Ergo o p, u q sinus secundi semissemis segmentorum habebunt æquales primos ductos à p & q. in commune punctum sectionis secantis & parallelorum. & proinde per 15 e. s. semissemis peripheriarum alternarum semiperipheria aut majores aut minores æquabuntur. Semissemis autem æqualium asses existunt æquales.

Itaq;

23. Peripheria circuli maximi secantis inter parallelas bifecatur parallelorum maximo.

nam si in sphaera amilari segmenta columnarum inter tropicos bifecantur ab æquatore parallelorum maximo ut in precedenti schemate patet q. anguli inter parallelas æquales ut 150 utrumque comprehensum bifecat ab æquatore parallelorum maximo.

Nam si ducatur circulus magnus secans parallellos & maximum secantem parallellos, secans (inquam) per polos: ex 12 e constabit segmenta & parallelorum & secantis maximi à secante in reliquum aut parallelum aut datum secantem æquari. Hæc ergo segmenta æqualia de quadrantibus æqualibus, qui secantur per parallelorum maximum, relinquunt segmenta peripheriæ æqualia inter maximum parallelorum & utrinque parallellos æquales. Quare tota peripheria inter parallellos est bisecta.

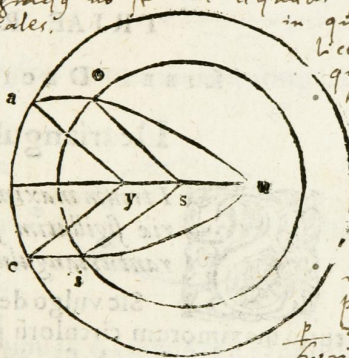
24. Si duo maximi sphaerae circuli in parallelorum polis ^{si duo circuli max.} concurrant: secant parallelorum peripherias similes. ^{intersecantes, quales} parallelas, in parallelo.

23, p. 3. *Regiom.*

Sint circuli paralleli a e,
o i. eos duo maximi circuli
secant p polos a u, e u. Dico
peripherias a e, o i esse simi-
les. Ducatur em̄ cōmunis se-
ctio secantium à polo u. Ea
continebit parallelorū cen-
tra per 9 & 7 e. & sint ca
y & s. Ab his centris sint sui
radii y a, y e & 50, 51. jam
quia ex eadem sectione egre-
diuntur in planis parallelis
binæ conterminæ o s i. &
a y, y e: erunt o s & a y itē
si, & y e parallelæ per 13. e. 2.
anguli a y e, o s i æquantur: &
duo rectos: sed ut y vel s ad
peripheriam. Quare a e ad o i sunt

Hinc vulgò Geographi magna sumunt subsidia in quærendis
locorum distantis adhibito 8. e 1.

Sic breviter excerpimus ea & collegimus: quæ usui fore videbantur. pleraq; enim alia ex his consequuntur cognita doctri-



m polis: si duo erunt, nix
 intersecantes plures
 ailes. parallelas, in parallelo.
 polis committunt secant p
 parallela sunt simili ter, sta
 talis sit numerus gradue
 in quolibz inter segmenta
 licet armis isti sint in
 quales. Exptm esto in
 horizontis & duobz
 & aqua tore pa
 rallela nem nuxo.
 Dico segmenta hori
 zontis ab aequatore
 in parallelas utrinque
 aequari. sciat n. m
 ndia: aq. & hor. p
 polis. manifestu e
 r e. hujz, segmenta
 horizontis a meridiano
 in aequatore utrinque a
 equari. Ex eodem q
 el: manifestu e q
 segmenta horizont
 a meridiano usq
 in parallelos aequan
 t. igitur si ab aequa
 lib: quadrantib: au
 ferant relinquant
 horizontis segmenta
 aequalia.

na sinuum: Et si quæ præterea ab Astronomis à Geographis & omnino à Cosmographis desiderari videbuntur: ea explebit liber sequens: qui triangulorum sphaericorum continebit doctrinam. unde ea brevissimè Astronomis probari poterunt: quæ per longas & propositiones & propositionum demonstrationes libri 3 Theodosii Vogelini in Astronomia demonstrari putat. Sed Vogelini studium laude est dignissimum: qui de usu propositionum quas doceret cogitavit: utinam multos haberet successores qui non modo propositionum verba, sed & usum aliquem subindicarent: nec tam veterum propositiones vellent retinere: quam in pulvere usui accommodatas exercere.

TH. FINKII GEOMETRIAE ROTVNDI,

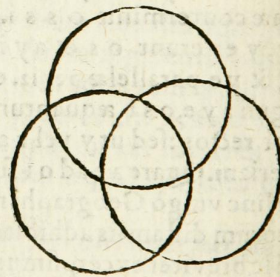
LIBER DECIMVSTERTIVS.

De triangulis sphaericis.



I trium maximorum sphaerae circularum peripheriae sigillatim semiperipheria minores concurrant: triangulum constituunt sphaericum.

Sic vulgo definitur triangulum sphaericum concursu maximorum circularum pyramide triangularis basis, quam faciunt inscriptæ arcuum, facientium, ut deinceps magis apparebit, posset etiam definiri concursu æqualium circularum: at rum si minores sint rectangulum triangulum non facient: sin majores & minores: jam calculum non admittunt. Arcus autem sectos per



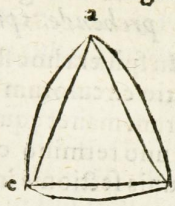
pyramidis

pyramidis dictæ basis latera, latera triangulorum deinceps, jam ulitato modo, dicemus.

2. *Trianguli duo qualibet latera sunt maiora reliquo.*

37.p.3.Regiom.

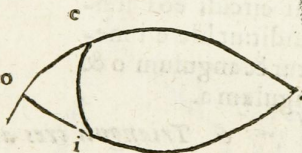
Hæc affectio cõmunis est & triangulo plano, ut & inscquentes nonnullæ: catholica ergo doctrina requireretur. Causa autem est ex triangulo plano: nempe ex basi pyramidis ad cẽtrum sphæ-
ræ factæ. ut esto triangulum a e i sphæricum. sint etiam singulo-
rum arcuum inscriptæ nempe latera basis py-
ramidis: Hic a i, & i e inscriptæ sunt maiores
quam a e inscripta per 7.e.6.R. Ergo secant a i
& i e maiores peripherias quam a e per 14.
e. 2. Eodem modo a e & e i sunt maiores
quam a i & c.



Itaq;

3. *Trianguli tria latera sunt minora duabus semiperi-
pheriis.* 39.p.3.Regiom.

Esto enim triangulum a e i. di-
co tria ejus latera esse minora
duabus semiperipheriis. concur-
rant enim latera a e, a i in o. Erunt
a e o, a i o semiperipheriæ duæ.
per 1.e & 13.e 12. jam per præmil-
sum o e & o i sunt maiora latera
quam e i. Quare adjectis communibus a e, a i: erunt a e, e i, i a mi-
nora quam a e o, & a i o.



4. *Anguli trianguli sphærici amplitudo est penes ar-
cum maximi circuli qui ex angulo tanquam polo descri-
ptus angulum subtendit,*

Hoc sic sumimus. Et tamen angulus est ad cẽtrum sphæ-
ræ si ex quadrantibus admittantur radii ex terminis arcus subtenden-
tis angulum. Vel si ex cruribus anguli æqualibus in communem
sectionem sinus cadant. prout hæc in ipso globo apparent. Et

(Causa e quæ nobis in seipso magis cõmuni
non minus)

V sic

hic 1 & 13 propositione Copernicus angulum trianguli metitur item Regiomontanus 34.p.4.de triangulis. Et hinc etiam Regiomontanus 4.p.5.angulum per inscriptas metitur, ut illic videre licet.

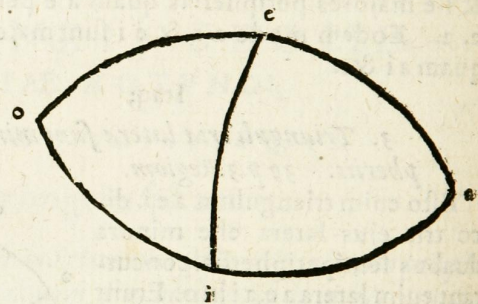
Hinc patet & illud quod Regiom.30.p.3. habet: anguli ad 4. rectos rationem eam esse quæ sit peripheriæ metientis angulum ad totum.

Itaq;

5. Si anguli crura continuata concurrant: angulum comprehendent prædicto æqualem.

In sphaera hoc statim apparet. Nam rectitudo, inclinatio, declinatio circulorum majorum manet equalis ab uno termino communis sectionis in alterum.

Et etiam hinc patet: quia idē arcus magni circuli eos subtendit: ut hic e i metitur & angulum o & angulum a.



Si anguli o i e major fuerint
et ea angulo trianguli tres
angulos majores esse dicitur
69 rectis ita probatur:
in triangulo o i e, anguli
li ad o & a æquantur
se & angulo o i e majores
e i e a angulo o i e
fi. Ideoq; e i a major
erit o i e. Bis bini
anguli o i e, o i a b i o
ion duobus rectis æqua-
les sunt, minores b i e
e o angulis. Itaq; si
tertio e o i addatur
et majores ipsi dem rectis erunt.

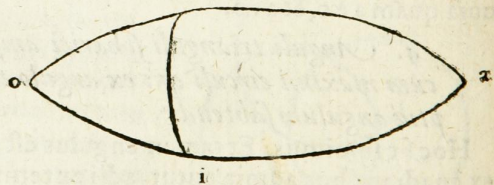
6. Trianguli tres anguli duobus rectis sunt majores.

49.p.3. Regiom.

Est triangulum
a e i. dico ejus an-
gulos esse majores
duobus rectis.

Continuent enim
crura a e, a i in o.
Erit angulus o i e
angulo i e a aut æ-
qualis aut inæqua-
lis.

Tertium enim dari nequit. Si æqualis addatur ipsis commu-
nis



nisi eia fient æquales. At o ie , $ei a$ sunt duobus rectis æquales. Nam recta in communem sectionē incidit ergo per 1. c. 8. e. 5. R. facit angulos duobus rectis æquales. itaque & anguli $a ei$ $ei a$ sunt æquales duobus rectis: addito ergo angulo $e a i$ sunt majores.

Si jam angulus $a i e$ sit inæqualis esto exempli gratia minor. Ergo cum inæqualibus o ie , $ei a$ additur idem $ei a$. & anguli ad i æquantur duobus rectis: duo $a ei$, $ei a$ erunt majores duobus rectis: & proinde tres multo magis majores. Eodem res redibit si $a i e$ sit major: tum enim $a ei$ erit minor: & angulus o æquatur angulo $a per s$ e. unde concludes propositum.

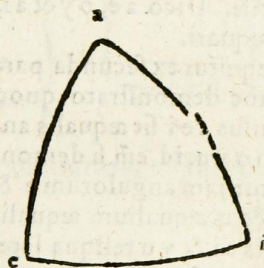
Et sic diversum aliquid hic habemus à triangulis planis. Illic enim tres æquantur duobus rectis 9. e. 6. R. hic majores sunt. Ergo non omne triangulum æquat suos angulos duobus rectis.

7. Si triangulum est æquicrurum est in basi æquiangu- lum: & contra. 41. 40. p. 3. Regiom.

His diu immorari non est necesse: Hæc ut communia sunt cum planis: sic communem ha- bent demonstrationem.

Vt hic duo anguli e & i sunt æquicruri & æquibases. Nam illic $a e$, ei hic $a i$ ie crura æ- qualia, basis illic $a i$, hic $a e$ ex- thesi æquales. Ergo per 1. c. 6. e. 3. R. anguli e & i sunt æquales.

Conversa similiter per absur- dum patet ut 10. e. 6. R.



8. Trianguli majus latus subtendit majorem angu- lum: & major angulus à majori latere subtenditur. 43. 42. p. 3. Regiom.

His diu immorari non est consultum. debebant alibi & gene- ralius doceri. Demonstratio ex doctrina angulorum contexi- tur ut 11. e. 6. R.

V 2 9. Sē

Hujus elementi tres sunt partes. Si duo triangula æquantur
 angulis duobus æquibus sunt æquilatera. Si duo triangula æquan-
 tur binis angulis & dictos angulos adjacentes latere sunt æquilatera. Si
 duo triangula æquantur binis angulis & unum angulum & unum latere
 basi alterius æquali. Unus angulus æquus. Dente, ar reliquum opus angulorum
 æquantur bases sunt sumptæ. **G E O M E T R I A E**

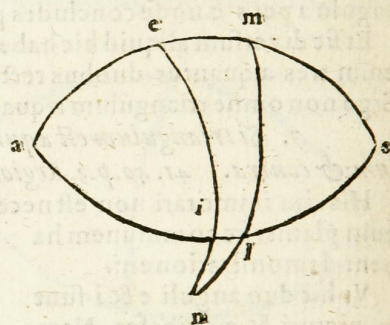
semiperipheria inæqua. Si duo triangula æquantur angulis aut duobus æqui-
 les sunt triangula sunt cruris, aut binis duorum æqualis cruris aut basis, ita ut re-
 æquilatera. Hujus sunt liquorum duorum æqualium bases semiperipherie inæqua-
 nis partis demonstrat.

Si duo triangula æquantur les sint: sunt æquilatera. 36.52.53 p.3. Region.
 Si duo triangula æquantur binis angulis & latere dictos ang: Et hoc maxima ex parte commune est planis. primæ partis &
 adjacentes sunt æqui: secundæ demonstratio eadem est cum planis: nempe triangula
 tera. Triang: de i: æquicrura angulo æqua æquari basi & triangula æqua binis an-
 on y sunt triang: ang: gulus æqualis cruris adjacentis reliquis lateribus æquari. Quare
 et binis angulis inde huc transferantur.

ad i & n; ad e & y. Tertia pars ab illis ali-
 & latere dictos an- quid diversi habet. Sint em
 gulos adjacentes sunt duo triangula a e i, o y u.
 e i & y n; qd em Sintq; anguli a & i æquales
 ex thesi æquantur angulis o & u. æqualis basis
 eo triangula æ duorum nempe e i & y u. re-
 o u y sunt æquilatera. liqua quoque latera a e, y o
 Prob: min: q e & y non sint æqualia semiperi-
 anguli sunt æquales pherie. Dico a e, o y & a i,
 Nam reliq; hinc ad o u æquari.

i & u æquantur ex thesi. Anguli ad e & y æquantur eadem vñ angulo ad m. Tercia pars: hoc demonstrato quod
 triang: o y u, angulus a e i sit æqualis an-
 gulo o y u. id em si demon-
 p sequens el: æquif- stratur jam angulorum e &
 gula. Nam o y, m stratur jam angulorum e &
 p fabricam, & ang: cruris e i & y u æqualium æqualis
 li ad o & u æquif- ra a e, o y & a i, o u erunt æqua-
 in eide vñ ad a. lia. Demonstratur itaque.
 Vide cate: in comen: Continuetur ergo a e & a i
 Copp: in s. fient semiperipheria.

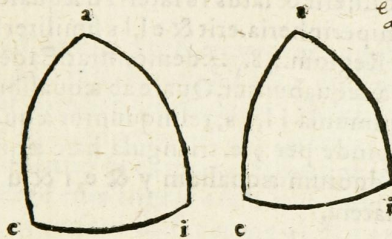
jam ex a s scindatur s l æqualis ipsi o u. & ex a s auferatur s m
 æqualis y o. Distant igitur a & m. Nam ex thesi o y hoc est s m &
 ænon æquantur semiperipheria. Et y u & m l æquantur ex pri-



ma parte. Deinceps ei & ml concurrant in n. Cum itaq; anguli i e & s l m æquantur. Nam eidem ad u æquantur illic ex thesi. hic vero quemadmodum mox patebit: erunt anguli trianguli i n l ad i, l æquales, & n i, n l æqualia latera per 7 e. Et cum ei & ml æquantur. nam æquantur eidem nempe y u illic ex thesi: hic ex prima parte. Ergo additis æqualibus n e, n l æquabuntur & anguli n e m, n m e per 7 e. proindeq; reliqui de æqualibus nempe duobus rectis a e i, l m s, hoc est ut patebit jam o y u. His jam æqualibus per secundam partem a e, o y & ai, o u æquabuntur.

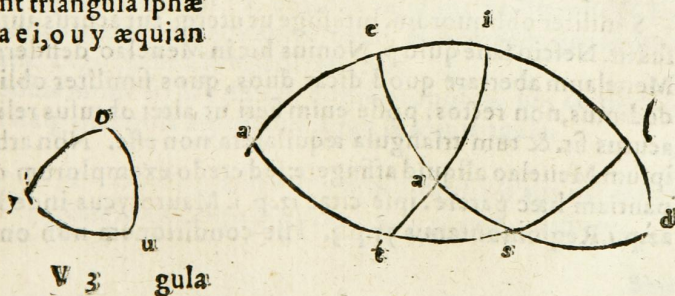
10. Triangula æquilatera sunt æquiangula: & contra. *Demonst. quæsa qz*
 36. 54. p. 3. *Regiom.* *hæc in polanis vobis triangula sphærica*
non erat. æquiangula, sunt æq
latera. Triang: ex
æquilatera. Triangulu vñ
e a i æ eidem t s a trian
æquilatera, go inter se ex:

Propositio cum planis ut communis est sic communem cum iis demonstrationem habet ex 1. c. 6. e. 3. R. ut hic si a e & a e item a i & a i æquantur & sit basis ei basi e i æqualis: anguli ad a æquabuntur, sic anguli ad e & i. eadem ratiocinatione.



Conversa sphericis peculiaris est. Nec enim plana triangula æquiangula semper sunt æquilatera. Ejus ergo demonstratio apud Regiomontanum hæc est.

Sint triangula sphærica a e i, o u y æquian



V 3 gula

gula: nempe o & a, i & u, e & y æquales. Continuëtur ergo i a & e a i n t & s, ut a t & o u, a s & o y æquentur per 15 e 2. Erunt proinde t s & y u æquales. Nam angulus e a i hoc est y o u æquatur angulo verticali t a s. Et crura a t, o u & a s, o y æquantur. Ergo per 9 e bases æquantur t s & y u. Et proinde per primam hujus partem triangula sunt æquiangula t a s & y o u. Nempe anguli s & y, t & u. Sed angulo u æquatur angulus a i e, & angulo y æquatur angulus i e a. Ergo angulus a s t angulo i e a. & angulus a t s angulo e i a est æqualis.

His jam datis continuentur e i, t s ut concurrant in m & l. dico e l & l s æquari semiperipheriæ itemq; i l & l t. quod facillè patet. Nam si concipias angulum l e s æqualem a s t. & continuës e s, e l donec concurrant in d. fient anguli l d s & l s d æquales. cum æquentur æqualibus d quidem angulo ad e per s e. s vero suo verticali: erit & latus l s lateri l d æquale per 7 e. itaq; cum e l, l d sit semiperipheria. erit & e l, l s similiter semiperipheria. Et id est quod Regiom. 48. p. 3. demonstrat. Eadem ratione i l, l t semiperipheriæ æquabuntur. Quare ab æqualibus semiperipheriis ablata communia i l, l s, relinquuntur æqualia t s, hoc est y u & e i. Et proinde per 9 e. triangula hæc æquiangula cum æquentur crure duorum æqualium y & e, i & u æqualibus e i, y u erunt æquilatera.

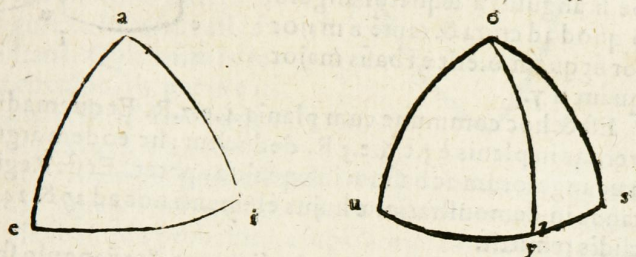
Si bina triangula
bina altera æquantur
duos anguli quibz
fuerit lateribz æquales
sunt & duo reliqui
lateribz oppositi aut
anguli aut similiter
fuerint, triangula
æquilatera. v. q. 12.

11. Si duo triangula æquantur angulorum æqualium duorum, duorum vero similiter obliquorum basibus: sunt æquiangula. 55. p. 3. Regiom.

Similiter obliquorum. intellige ut uterq; aut acutus aut obtusus sit. Nescio sanè quid p. Nonius hic in Menelao desideret. ait Menelaum aberrare quod dicat duos, quos similiter obliquos dedimus, non rectos. posse enim fieri ut alter obtusus reliquos acutus sit. & tum triangula æquilatera non esse. Non arbitror ipsum Menelao aliquid affingere: sed credo exemplorum discrepantiam hæc parere. ipse citat 13. p. 1. Maurolycus inde habet 22. p. 1. Regiomontanus 55. p. 3. Hic conditionem non omittit.

Nec

Nec Maurolycum, si rectè memini omisisse puro. Nescio quale ipse exemplar habuerit. Quod si litera ut refert habuit. Mathematicè certè fecit acius propositiones examinans: & benigne fecit, benigne authorem interpretans.



Sint itaque duo triangula $a e i$, $o u y$: & æquantur anguli duo e & u æqualium basium $a i$, $o y$: rursus anguli i & y sint similiter obliqui nempe acuti aut obtusi & subtendantur ab æqualibus basibus $a e$, $o u$. Dico triangulorum reliqua latera $e i$ & $u y$ æquari. Secus si non æquantur sit $e i$ majus. & protrahatur $u y$ in s ut $u s$ æquetur $e i$. Ergo cum anguli e & u æquantur & $e a$, $u o$, itemque $e i$ & $u s$, ex adversarii thesi, per 9 $e a i$ & $o s$ æquabuntur, & anguli i & s . Sed arcui $a i$ æquatur ex nostra thesi $o y$. quare $o y$ & $o s$ æquabuntur & per 7 e anguli ad s & y æquales erunt: & quidem cum $o s y$ sit acutus: est enim acuto i æqualis: etiam $o y s$ erit acutus: & proinde reliquus de duobus rectis $o y u$ erit obtusus. At hoc contra thesin elementi est: qua acutus dabatur: Ergo thesis adversarii falsa fuit.

Eodem modo si i & y dentur obtusi propositio sibi constabit. Sunt itaq; triangula æquilatera: Ergo & æquiangula.

12. Si triangulum triangulo æquicrurum est majus basi: est majus angulo: & contra. 51. 50. p. 3. Regiom.

Sint

Sint enim triangula duo sphærica aei, ouy æqualium crurum a e, ou & ai, oy. basis autem ei majoris basi uy. Erit angulus a major angulo o. Et si hoc: nempe si angulus a æquetur angulo o quod ad crura & tamē a majorior sit quam o. erit ei basis major quam u y.



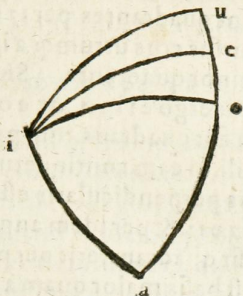
Est & hoc commune cum planis 4.e.7.R. Et quemadmodum veritas in planis ē 3.c.6.e.3.R. deducitur: sic eodem argumento hæc angulorum ac basium inæqualitas patet. Et sic Regiomontanus in demonstratione huius elementi nos ad 25 & 24.p.1. Euclidis remittit.

Atq; sic habuimus quæ generalia erant, & triangulo sphærico simpliciter & triangulis comparatē: deinceps de triangulorum speciebus agendum erit: Et primo quidē de rectangulo. Rectangulum autem hic tr & obtusangulum non astringitur ad rectum unum, unumq; obtusum. fieri enim potest ut in eodem triangulo plures sint. Et quidem tres recti rectanguli esse possunt: geodæsia tamen & calculus unum rectum plerunq; postulat.

In triangulo rectangulo si crur recti quadrans sit, angulum subtendit rectum: quadranti inaequale similiter recto inaequalem angulum ei oppositum est rectum: quadranti inaequale similiter recto inaequalem angulum ei oppositum est rectum: quadranti inaequale similiter recto inaequalem angulum ei oppositum est rectum. 3.p. 4. Regiom.
Similiter inaequalis angulus dicitur ut recto maior aut minor prout crur recti majus aut minus quadrante est. Quadrantem autem voco pro peripheria quadrantis.
 Esto ergo triangulum rectangulum recti anguli ad a. sitq; crur ejus a e quadrans. dico angulum ad i esse rectum. Est enim per 17 e.12. e polus circuli i a. jam per polum e secat circulum a i. Ergo per 16 e.12 recte secat. & proinde angulus i rectus est. Quod si a e majus crur sit quam quadrans erit angulus i obtusus. Nam fiat polus in o. circuli i a & per polum secet circulus o i. fiet angulus primæ partis. Atq; circulus i a per polum secat recte secat per 16 e.12 ei secat in e. circulum a i per polum e. (Nam est ex thesi e quadrans p p: 80 p 17 e. p o b g erit.) 80 recte secat

Ius oia rectus, qui minor est angulo e i a dato. Eodem modo si e a sit minus crus quadrante: fiet u i a rectus: & proinde major quam e i a.

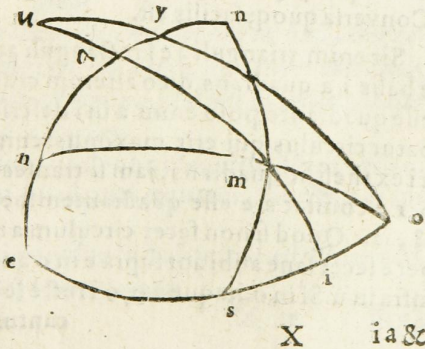
Conversa similiter patet. Si enim angulus e i a rectus est: e a erit quadrans. Quia enim i e recte secat circulum i a: per 16 e 12. per polum secabit. Eodemque modo cum ex thesi e a recte secet circulum etiam per polum secabit. itaq; concurrent in polo per 18 e 12. Quare erunt quadrantes maximorum circulorum. Eodem planè modo probabis e a superare quadrantem si angulus i obtusus sit: superari ab eo, si acutus. Nam ut illic o a erit quadrans & tum minor quam a e: sic hic a u erit quadrans major quam a e.



14. Si trianguli rectanguli crus unum quadrans fuerit, & basis quadrans erit: sin crura quadrantibus similiter inæqualia fuerint: basis quadrante erit minor, si dissimiliter: basis erit major. & contra. 4. s. p. 4. Region.

Similiter inæqualia intellige ut crus utrumque aut majus aut minus quadrante sit. dissimiliter si crus unum majus reliquum minus quadrante extiterit.

Esto itaq; triangulum rectangulum a e i. recti i cuius crus a i sit quadrans. dico a e esse quadrantem. Nam per 13 e. angulus e est rectus. Quare perpendiculares



X ia &

cantur per 16 e 12. Et a e perpendicularis est ad e i ex thesi. Quare i est polus circuli a e per 17 e 12. Quare per idem e i crus alterum nempe trianguli erit quadrans.

Eodem modo colliges e i esse quadrantem si polo a in i. descriptus circulus fecer a e in u.

Rursus si sit a i minor quadrante crura erunt aut maiora eo aut minora. Si sit major quadrante erit crurum alterum majus alterum minus ut simili ratiocinatione facile colliges, sed impossibile Regiomontanus adhibet, ut & Euclides plerumque; conversas demonstrat. Nam si a i est quadrans erit crurum e i, e a alterum quadrans. secus si non sit: erit utrumque aut majus aut minus: aut alterum majus alterum minus quadrante: At si majus, si minus utrumque, basis a i minor quadrante: si unum majus reliquum minus a i erit major quadrante. At hoc est contra thesin.

Rursus si a i basis sit minor quadrante: erit crus utrumque aut majus aut minus. Secus si non sit erit unum quadrans aut unum majus reliquum minus quadrante. Quo posito a i illic erit quadrans: hic major quadrante per ante demonstrata. At a i nec quadrans nec major quadrante ex thesi: Ergo &c.

Eodem modo si a i basis sit major quadrante, alterum crus quadrante majus alterum eo minus erit. Nam si non sit: basis a i aut erit quadrans aut eo minor, ut jam patuit. At nec quadrans nec eo minor. Ergo crus alterum quadrante majus, reliquum minus.

Itaq;

15. Si trianguli rectanguli angulorum in basi alter rectus sit, basis quadrans erit: sin uterq; aequaliter obliquus, basis quadrante minor est: sin inaequaliter obliquus, major est: & contra. 6.7.p.4. Regiom.

Hoc elementum ex praemissis duobus sequitur. Nam si trianguli rectanguli crus unum quadrantem aequatur, basis quadrans est per 14 e.

At si trianguli rectanguli. angulus in basi rectus est crus recti, recto in basi oppositum est quadrans. 13. e.

X 2 Ergo

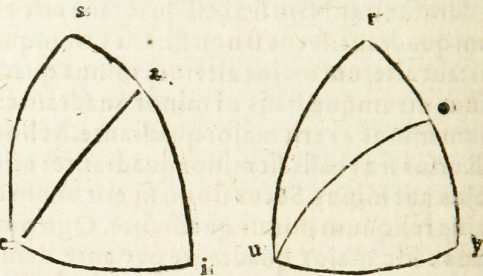


Ergo si trianguli rectanguli angulus in basi rectus est, basis est quadrans.

Sic reliquæ ejus partes ex præmissis duobus elementis syllogismi complexiones sunt. Et novis hic elementis nõ esset opus: dato enim antecedente syllogismi: vel non enunciata complexio vera est & intelligitur.

16. Si duo triangula rectangula crurum recti sigillatim quadrante minorum æquentur binis lateribus: sunt æquilatera. 56.p.3.Reg.

Sint enim rectangula $a e i$, $o u y$ rectos habentia ad i & y & $e i$, $i a$ rursus $u y$, $y o$. sigillatim quadrante sint minora. jam bina latera æquætur. Erunt ea aut crura: aut crus recti & basis



in utroque triangulo. Æquentur ergo primo $e i$, $u y$ & $i a$, $y o$. per 9 æquabitur $e a$ & $u o$. Quare triangula erunt æquilatera.

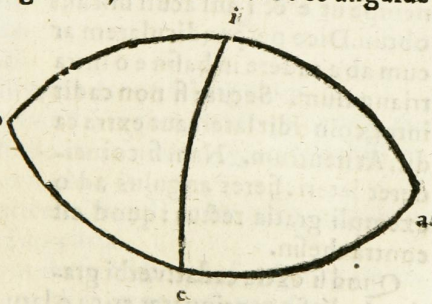
Secundo $e a$, $u o$, & $a i$, $o y$ æquentur. dico $e i$ & $u y$ æuari. Continuentur enim $i a$, $y o$ in s & r ut fiant quadrantes $s i$, $r y$. erunt in s & r circulorum subjectorum $e i$, $u y$ poli per 16 e 12. Rursus ab s & r descendant perpendiculares quadrantes $s e$, $r u$ æquales: sunt enim quadrantes æqualium scilicet maximorum circulorum. Sed & $a s$ æquatur arcui $r o$. sunt enim complementa æqualium $i a$, $y o$. & $e a$, $u o$ ex thesi æquantur. Quare triangula æquilatera cum sint erunt æquiangula & $s a e$, $r o u$ æquales anguli: & reliqui $e a i$, $u o y$ de æqualibus nempe duobus rectis. jam in triangulis $e a i$, $u o y$ anguli æquicruri æquales sunt. Ergo per 9 e. bases $e i$, $u y$ æquabuntur.

Sic de triangulo rectangulo hætenus diximus: quod ut nec ad quadrantem unum sic nec rectum angulum unum est redatum.

Etum. pro lateribus tres habere quadrantes potest & tum rectos tres habebit. aut duos habet quadrantes & tum totidem rectos: aut nullum habet quadrante & tum tantum unum rectum obtineret: & latera omnia quadrante aut minora sunt, aut duo majora tertium minus: Et illic, reliqui duo anguli erunt acuti: hic vero alter acutus alter obtusus: si modo rectus uni inæqualium laterum opponitur. Si enim rectus subtendatur à basi minore quam sit quadrans, anguli reliqui sunt obtusi. ut jam ante per aliquot elementa patuit.

Et hinc jam patebit quot in triangulo rectangulo data esse oporteat ut tertius aliquis & optatus terminus inveniatur. Certe constat datis præter rectum angulum quibuslibet duobus terminis tertium inveniri posse: absque alia aliqua laterum aut angulorum determinatione. Si tamen ex dato crure recto & angulo opposito basin inveniendam posuerimus: sit ne ea futura major an minor quadrante præsciamus oportet. id itaq; ex thesi dabitur: Calculus enim hoc non judicabit, potest enim fieri ut crure minore aut majore basi ramen major aut minor sit. Ita si dato crure cum angulo opposito crus reliquum inveniendum sit. aut angulus reliquus, ut in sequenti figura vides.

Esto triangulum $i e a$ rectangulum. cujus detur crus $i e$ & angulus a . & sit basis $i a$ minor quadrante nisi enim hoc constituerit dubium est: sit ne assumenda $o i$ an $i a$. Quia in triangulo $i o e$ eadē data manent. crus $i e$ commune. angulus o equalis angulo a p 5 e 13. & sinus $i a$ itē tangēs ac secās conveniunt: cū dictis basis $o i$ p 8 e 5.



Eodem modo si his datis velis inquirere crus alterum $e a$. nisi definias sit ne majus aut minus quadrante: calculus id non inveniet. Nam trianguli $i e a$ & $i e o$ communia data sunt. sed unius

X 3 crus:

G E O M E T R I A E

erius reliquum majus alterius minus quadrante existit: commu-
ni etiam sinu, tangente, secante. ita si in idem datis angulum i in-
vestigare velis nisi de ejus specie constet calculus eum non de-
finiet. Nam duorum triangulorum data sunt communia & ta-
men angulus i unius est obtusus, alterius acutus & utriq; inte-
rim responder idem sinus, secans eadem atq; etiam tangens.

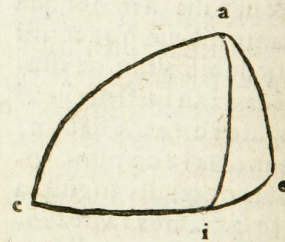
Sequitur de obliquangulo triangulo: quod ut in planis est
obtusangulum aut acutangulum. jam fieri potest ut obtusangu-
lum tres obtusos habeat, duos, etiam unum tantum. acutangu-
lum itaq; id tantum erit quod tribus est acutis de natum. De his
quædam sunt apud Regiom. 9. 10. 11. 12. 13. 14. p. 4. Quæ tamen ex
rectangulis cognosci possunt.

Ne tamen quis hic quicquam desideret: breviter ea subiiciam:
demonstranda tamen cuiq; ex superioribus modo jam prædi-
cto relinquam: præmisso hoc elemento.

17. *Si triangulum similiter in basi est obliquangulum:
perpendicularis arcus à vertice cadit intra triangulum:
extra si dissimiliter 8. p. 4. Reg.*

Esto enim triangulum a e i in basi similiter obliquangulum
nempe ut e & i aut acuti sint aut
obtusi. Dico perpendicularem ar-
cum ab a cadere in basin e o intra
triangulum. Secus: si non cadit
intra, coincidit lateri aut extra ca-
dit. At neutrum. Nam si coinci-
deret lateri. fieret angulus ad o
exempli gratia rectus: quod est
contra thesin.

Quod si extra cadat: verbi gra-
tia ad o basis continuatæ, erit a o latus commune duobus trian-
gulis rectangulis. jam in triangulo rectangulo a e o. quia angu-
lus e. exempli gratia est acutus per 13 e. a o. arcus perpendicula-
ris erit minor quadrante. Rursus quia a i e est acutus ex thesi. re-
liquus



liquus ad duos rectos a i o erit obtusus. itaq; a o per 13 e erit ma-
jor quadrante. & proinde major & minor eodem: quod est ab-
surdum.

Ergo perpendicularem dicto modo angulis in basi affectis
extra cadere est impossibile.

Regiomontanus ut primam partem induxit: sic secundā col-
legit: nempe perpendicularem non lateri concidere nec cadere
intra: si scilicet angulorum unus in basi acutus reliquus obtusus
sit: proindeq; cadere extra. Potest tamen & hoc modo ex pri-
ma parte colligi.

Sit enim rursus triangulum a e i, & angulorum in basi e sit acu-
tus, reliquus vero i obtusus. Dico perpendicularem à vertice a.
cadere extra datum triangulum.

Concurrant enim e a, e i in
u. Erit angulus u trianguli
a i u æqualis angulo e dato
per 5 e. & proinde acutus.

Deinde quia angulus e i a
est obtusus reliquus a i u erit
acutus. Ergo cum anguli i &
u in triangulo a i u sint ejus-
dē speciei nempe acuti: per-
pendicularis cader intra tri-
angulum factum. & proinde extra datum triangulum.

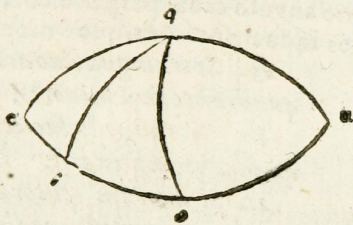
Sed hoc est syllogismi demonstrare complexionem: quæ ta-
men præmissis datis necessario concluditur. Quare syllogistico
judicio hæc pars contenta erit isto.

Si perpendicularis à vertice trianguli cadit intra: anguli in
basi specie iidem sunt. ex prima parte.

Adde assumptionem quam thesis adfert: At si angulorum al-
ter acutus alter obtusus sit: anguli specie non sunt iidem.

Ergo si anguli in basi dissimiliter sint obliqui: perpendicu-
laris non cadit intra. Ergo extra. Nam lateri coincidere nequit, ut
in prima parte est demonstratum.

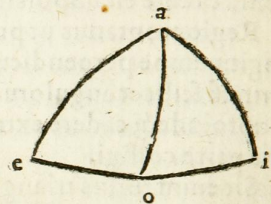
Hoc



Hoc itaque elemento expofito: fic de obliquangulis Regiomontani funt theoremata.

18. *Trianguli acutanguli latera figillatim funt minora quadrante. 9.p.4.R.*

Esto triangulum acutangulū, hoc est trium acutorum angulorum a e i. descendat arcus perpendicularis a o. fient triangula a o i, a o e reftangula. jam utrinq; cum ex thefi o a i, & angulus i. item o a e & ang. e. funt acuti: per 13 e. o a & o i item o a & o e figillatim funt minora quadrante. Quare per 14 e. & a i & a e figillatim funt minora quadrante. Eodem modo de e i conftabit fi ex alio angulo cadat perpendiculares. Et fic fequentes propofitiones induci poterunt, quod monuiffe fatis fit.



19. *Si trianguli duo acuti aequales funt: equalium bafes quadrante funt minores. 10.p.4.*

20. *Si trianguli duo acuti inaequales funt: minores bafis quadrante minor erit. 12.p.4.*

21. *Si duorum acutorum alterius bafis non fit minor quadrante: tertius angulus obtufus erit ejusq; bafis major quadrante. 14.p.4.*

Bafis poftulatur non minor quadrante: fed aut ei æqualis aut major. Et demonstratio facilis eft ex fuperioribus. Si enim in præmiſſo ſchemate a i fit quadrans jam aut a o aut o i erit quadrans per 14 e. ſed a o non eft per 13 e. Ergo o i & proinde e i major & angulus e a i obtuſus. Quod ſi a i fit major quadrante: erit, quia a o minor, per 14 e o i major & c.

22. *Si trianguli duo obtuſi aequales funt: equalium bafes quadrante funt majores. 11.p.4.*

23. *Si trianguli duo obtuſi inaequales funt: bafis majoris erit major quadrante. 13.p.4.*

Hæc funt quæ Regiom. habet de obliquis angulis. quæ ex reftangulis huc tamen redundant.

T H.

TH. FINKII GEOMETRIAE ROTVNDI,

LIBER DECIMVS QVARTVS.

De calculo triangulorum
sphaericorum.

Pervenimus tandem Dei gratia ad id quod inter cetera praecipue nobis propositum fuit: pervenimus, inquam, ad doctrinam calculi triangulorum: quae tam est late dissemita ac diffusa: quam late coelum & terra patent. Majori itaq; animi alacritate, studio & diligentia summâ ea erit perdiscenda: si modo ad coelum evolare, arcus globi terreni metiri bene voluerimus: si deniq; hinc in omnia vitae genera redundantem usum atq; fructum cognoscere cupiverimus.

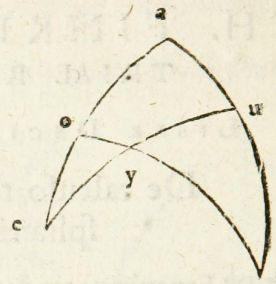
Calculus erit facilis & expeditus: deductus & ex lemmatis Ptolemei cyclicis auxilio tabularum Directionum Erasmi Rheinholdi, & ex Regiomontano nostro. Quare primo Ptolemaeum sua docentem e Menelao paulo plenius audiamus.

1. Si quatuor peripheriarum maximorum sphaerae circulorum sigillatim semiperipheria minorum, duae faciant angulum reliquae ab harum terminis reflexae se & priores faciant: ratio sinuum unius ad sinum sui segmenti vel segmentorum inter se fit e ratione sinuum ita conterminarum peripheriarum, ut prima facientium conterminetur principio antecedentis factae, secunda huius consequentis fini contermina terminetur in finem consequentis f. cte.

Sint quatuor peripheriae maximorum sphaerae circulorum sigillatim semiperipheria minores, quarum duae ea, ia faciant angulum, reliquae sint in se reflexae ab i & e secantes priores in o & u

Y se

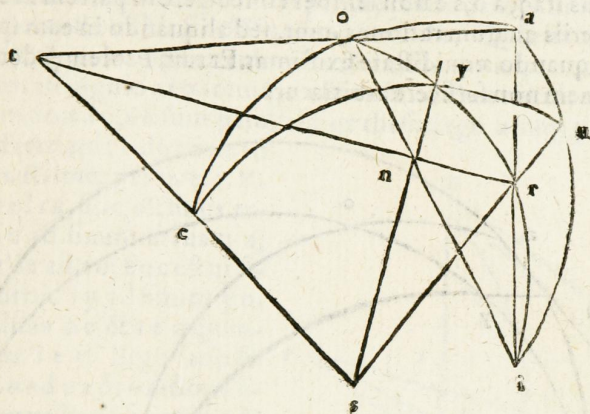
se ipsas vero in y. Hinc jam
variè ratio sinuum arcuum
particularium componitur:
prout in elemento est indi-
catum: Et sequens quorun-
dam casuū descriptio osten-
dit: ubi tamen pro ipsis arcu-
bus, arcuum sinus intelligen-
tur: Et antecedentibus ratio-
num terminis consequentes
subiecti intelligantur. Et sunt
prima duo exempla Ptolemæi.



Facientes.		Facta.	
A.	i y	o e	
C.	y o	e a	i u u a
I.			
	i o	y e	
	o y	e u	i a a u
II.			
	a e	o y	
	e o	y i	a u u i
III.			
	a o	e y	
	o e	y u	a i i u
IV.			
	i u	a e	
	u a	e o	i y y o
V.			
	o a	e u	
	a e	u y	o i i y
VI.			
	i a	u e	
	a u	e y	i o o y

Et

Et similes casus in reliquis duab. peripheriis colligere pores.
 Ptolemæus primum suum exemplum sic demonstrat.
 Sint inscriptæ arcuum o a, a i, i o, Et sit centrum sphæræ
 a ducanturque radii, s u quidem secans i a in r: & s y secans i o in



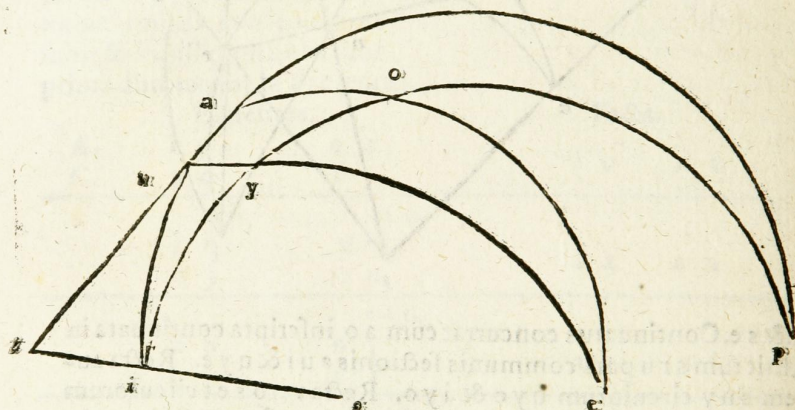
n: & s e. Continuatus concurrat cum a o inscripta continuata in
 t. Erit tum s r u pars communis sectionis a u i & u y e. Recta au-
 tem s n y circularum u y e & i y o. Recta vero s e t circularum
 u y e & e o a. Porro inscriptæ o a, a i, a o t sunt simul in triangulo
 a o i. Suntq; communes sectiones trianguli dicti cum dictis cir-
 culis. itaque cum r, n, t, sint in dicto triangulo & circulo u y e.
 erunt in communi sectione dictorum planorum trianguli nem-
 pe atque circuli hoc est in una recta. Nam plana terminantur li-
 nea: ergo linea secantur per c. 5. e. 1 R.

jam cum quatuor rectæ sint duæ facientes angulum a t, a i. re-
 liquæ ab harum terminis i & t reflexæ nempe i o, t r secantes se
 & priores: per 15. e. 5. R. ratio i r ad r a, hoc est per 13 e 5. sinus ar-
 cus i u ad sinum arcus u a, fit è ratione i n ad n o, hoc est per di-
 ctum elementum è ratione sinus arcus i y ad sinum arcus y o, &
 ratione o t ad t a, hoc est per 14 e 5 è ratione sinus arcus o e ad si-
 num arcus e a.

Y 2 Ptole-

Prolemaicam demonstrationē omnibus inductionibus non
sufficere arbitratus est Thebitius Arabs Corę filius: sic enim Ben-
corat vocant: itaq; eam auxit. ut refert Maurolycus ad 1. p. 3. Me-
nelai: qui etiam adfert Thebitii lemmata & demonstrationes.

Rectas itaq; a o, s e non semper concurrere in partem averfam
peripheriis quarum rationes sunt, sed aliquando in eam ipsam,
imo aliquando æquidistare existimat. Et tum Ptolemęi demon-
strationem non sufficere arbitratur.



ut in hac figura sit centrum s. Hic si a o continuare velis in dex-
tram partem nunquam concurret cum radio: at versus sinistram
a u coincidit cum eo ad punctum t. itaq; per Ptolemęi demon-
strationem ratio sinus e o ad sinum o a componitur è ratione e y
ad y u, & u i ad i a.

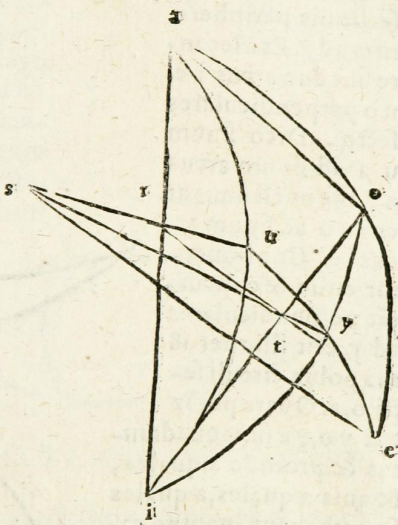
Reliqua pertexit ex lemmatis suis & modis sex quantitatum:
hoc est per multiplicationem proportionum: Nec quicquam
modi sunt aliud quam exempla istius multiplicationis. Sed reli-
qua sic pertexentur: in versis prioris proportionis terminis: &
completis semicirculis i a p, i o p. Ratio sinus arcus i a, hoc est si-
nus p a per s e s ad sinum a u, fit è ratione sinus arcus i o, hoc est
p o ad

po ad sinū arcus oy, & ratione sinus arcus ye ad sinū eu. Quod Ptolemæi primum est exemplum: at dices quis dedit ia ad au sic fieri? Secundum Ptolemæi exemplum id habet. itaq; specialibus ejusdem generis omnibus satisfecisse Ptolemæum credo. Nam si radius & inscripta dicta parallelæ sint demonstratio cuiusvis obvia est: ut hic ha o & s e sint parallelæ. Quia itaq; sunt in eodem plano nempe circulo a o e: & rursus ao atque rt sunt in eodem triangulo a i o. item q; r t & s e in eodem circulo u y e: & harum duæ a o, s e sunt parallelæ ex thesi. Ergo utraq; parallelæ est ad tertiam r t docente id

6. e. 21. R. itaq; per 13. e. 5. R. ut i ad ra, hoc est sinus arcus i u ad sinum arcus u a, est ut i t ad t o, hoc est ut sinus arcus i y ad sinum y o. jam sinus o e & a e æquantur per 8 e 5. Ergo ratio sinus i u ad u a fit è ratione sinus arcus i y ad sinum y o & ratione sinus arcus o e ad sinum arcus a e. Nam ratio hæc ultima sinuum æqualitatis est, ideoque rationem non mutat.

Secundum suum exemplum Ptolemæus demonstrat ad primi modum. in quo eadem Thebitius desiderat. At nos Theonis demonstratione contenti sumus quam paulo ante attulimus. ut in secundo schemate ratio pa ad au hoc est ia ad au fit è ratione po, hoc est io ad oy, & ratione ye ad eu. Et hæc demonstratio omnibus casibus hujus generis exemplorem convenit. Reliquos casus ex hactenus dictis similiter expedites.

X 3 2. Hinc

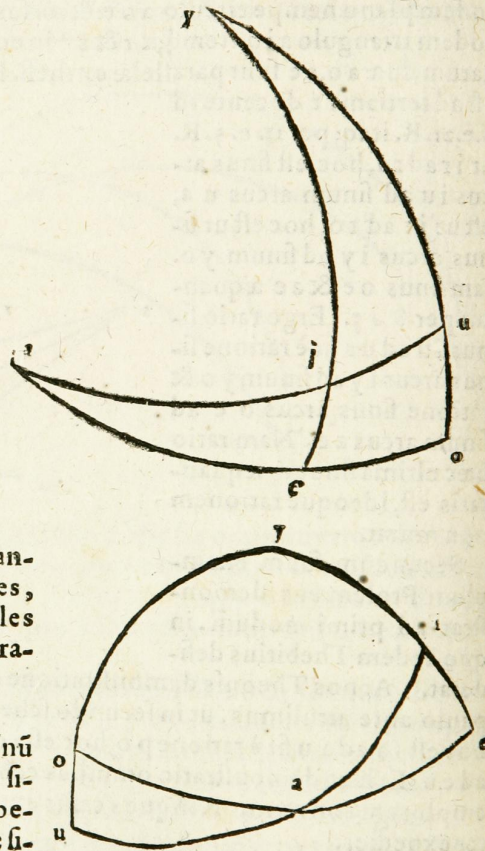


2. Hinc quatuor consequuntur primum: Si maximus sphaerae circulus maximum secet, & à secante duo arcus perpendiculares reliquo ducantur: sinus segmentorum secantis à sectionis puncto directè sunt proportionales sinibus arcuum perpendicularium. 15.p.4.Region.

Esto secet maximus sphaerae circulus u a, maximū o a. sitq; terminus intersectionis peripheriarum ad a. Et à secante sint duo arcus i e, u o perpendiculares secto. Dico sinum u a ad sinum arcus a i esse ut est sinus arcus u o ad sinum arcus i e. Continuentur enim & concurrant perpendiculares ad y. erit illic per 18 e 12 polus circuli secti o a. Quare per 17 e 12 y o, y e sunt quadrantes & proinde æquales, & quia æquales, æquales sinus habent, nempe radium ut ante paruit.

Hinc conclude.

Ratio sinus u a ad sinū arcus a i fit è ratione sinus arcus. u o ad sinū peripheriæ o y. & ratione si-



nus

nus arcus y e ad sinum e i. At hæ inter se multiplicatæ sunt ratio
sinus arcus u o ad sinum arcus i e. per multiplicationem ratio-
num. heterologi enim æquales sunt. nempe sunt radii.

Sin. u o. Radius u a. a i.
Radius sin. e i.

Ergo hinc jam sequitur elementum ipsum. cuius vires in cal-
culo triangulorū multæ sunt: maximæ in calculo rectangulo-
rum: quorū ea Geodæsia hæc recipit quæ unum habent rectum.

In sequentibus autem demon-
strationibus nos ejusmodi adhibe-
bimus triangulum cuius crura re-
cti sint minora quadrante, & pro-
inde anguli in basi acuti. ut triangu-
lū a e i. cuius angulus e rectus sit.

Et quicquid de ejusmodi trian-
gulo demonstratum fuerit: verum
erit etiā si crura sint quadrante ma-
jora, proindeq; anguli in basi obtu-
si. ut hic quod de

sinistro triangulo
fuerit monstratū:
id verum erit de
dextro. Nam cru-
ris e a illic & hic,
sinus idē est: item

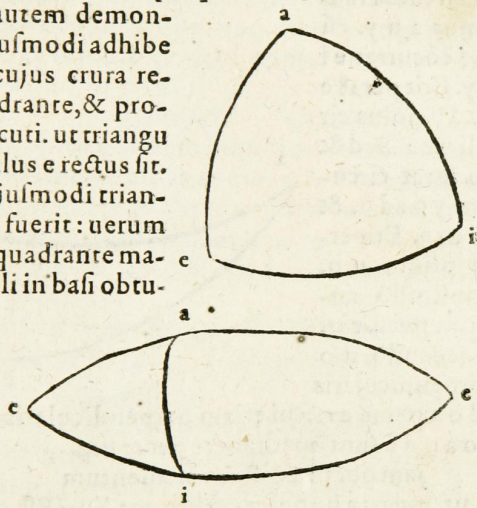
e i illic & hic. Sic angulorum ad a & i acutorum & obtusorum
sinus iidem sunt per 8 e 5.

Eodemq; modo si crurū illud quadrantem superet hoc vero à
quadrante excedatur. Quia sinus, ut jam dictum est, & proinde
etiam tangentes ac secantes non mutantur. Quare jam matris
secundæ filias amabiles videamus.

Itaq; in triangulo rectangulo.

3. Radius est ad sinum basis, ut sinus anguli ad sinum
cruris dicto angulo subtensi. 16 p. 4. Region.

In



In rectangulo crus recti ut & basis recti intelligitur.

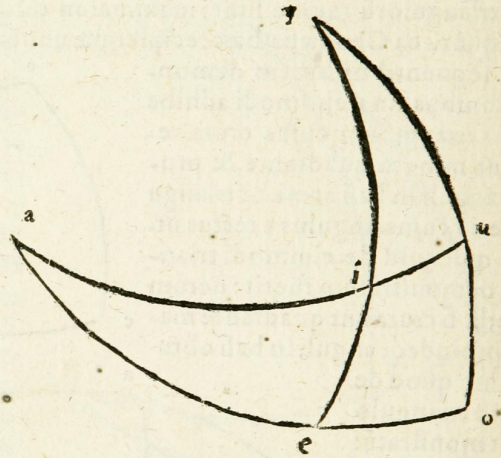
Esto triangulum rectangulum $i e a$.

Dico esse proportionales

Rad. sin. $a i$. sin. a . sin. $i e$.

Rad. sin. $a i$. sin. i . sin. $e a$.

Facto enim polo in a , describatur circulus maximus $a u y$. cū quo cōcurrat $e i$ in y . Erit per 18 e 12 ad y polus circuli $o e a$. Sed & $a o$ fecer circulum $y o a d o$. & $a u$ in u . Erit ergo primo $u o$. amplitudo anguli a per 4 e 13. & secundo $u o$ perpendicularis



ad $o a$ per 16 e 12. cui etiam perpendicularis est ex thesi $i e$. Tercio $a u$, $a o$ sunt quadrantes per 17 e 13.

jam per prædictum elementum

ut sinus $u a$ hoc est ex fabrica radius (Est enim quadrans) ad sinum arcus $a i$, hoc est basis dati trianguli, sic sinus $u o$, hoc est sinus anguli a ex fabrica ad sinum $i e$ cruris nempe dicto angulo subtensi. Eodem modo res patebit de angulo $e i a$. & ei opposito crure $e a$.

Hinc jam patet inventio horum trium terminorum basis, anguli cum crure opposito, datis duobus: idque multiplicationis aut divisionis via. Verum ut multiplicationis ratio tanquam facilius retineatur: adhiberi tantum elementum in expresso casu satis est: reliquis enim sua etiam erunt elementa: ut radius primus aureæ regulæ terminus existat.

Sunt

Sunt ergo hujus elementi data præter angulum rectum basis recti & angulus. inventū erit crus recti angulo dicto oppositum. Et ne res exemplo careat:

Derurbasis i a gr. 30.

Angulus a. gr. 23. 28'. Quantus est minima inclinationis Zodiaci ad Æquatorem Copernico.

Quæritur i e. arcus nempe quem Astrologi vulgo declinationem vocant puncti Zodiaci ab Æquatore.

Ex canone i a sinus datur 5,000,000. sinus vero anguli a. 3,982,155. Ergo sinus i e invenietur 1,991,077½.

Rad. i a a. i e

2. 1. 3,982,155 1,991,077½.

Sinus inventus in canone sinuum monstrat arcum gr. 11. 29' 5". ut etiam in tabula sua Rheinholdus annotavit. Eodem modo si angulus a esset obtusus gr. 156. 32'. sinus quidem maneret & inveniretur idem. verū e i non amplius esset gr. 11. 29. 5. Sed 168. 30. 55", major scilicet quadrante per 13 e 13. & per 8 e 5. reliquus ad semiperipheriam arcus gr. 11. 29. 5.

4. Radius est ad sinum complementi cruris, ut sinus complementi reliqui cruris ad sinum complementi basis.

19. p. 4. Regiom. 3. theor. Gebri.

ut retento triangulo nostro sunt proportionales

Radius. sin. compl. i e. sin. comp. e a. sin. comp. i a.

Manente enim fabrica prioris figuræ erit u i complementum basis. i y complementum cruris i e, e o complementum cruris a e. Sunt enim ex præmissa fabrica y e, a u, a o quadrantes. At vero per 2 e. ut sinus e y radius ad sinū y i, sic sinus e o ad sinum i u.

Quare data hujus elementi præter primum aureæ regulæ terminum sunt crura: quæritur basis.

Detur exempli gratia e a. grad. 27. 54'. 20" at i e grad. 11. 29'. 5".

Quæritur basis.

Ex canone igitur sinuū datur sinus cōplementi e a. 8,837,203. complementi i e 9,799,778. Hinc elementum dictum inveniet sinum complementi i a. 8,660,263.

Z Comple-

Complementi

i e e a i a

10,000,000. 9,799,778. 8,837,203. 8,660,263.

Sinui invento responder arcus grad. 60. ejus complementum est basis grad. 30.

Sed cur basis non est gr. 150? Quia crura sunt minora sigillatim quadrante ex thesi. Ergo per 14 e 13. basis est minor quadrante.

Ac si crus i e fuisset 168. 30. 55. & crus e a. gr. 152. 5. 40. Et tum basis etiam esset gr. 30.

Verum si crus i e quidem fuisset grad. 168. 30. 55. e a vero grad. 27. 54. 20. tum basis esset gr. 150. nempe reliquus peripheriæ gr. 30 de 180. per 8 e 5. Eodem modo deinceps accommodabis exempla ad trianguli crura latera majora, minora quadrante: ad angulos obliquos. jam bis monuisse satis sit. Et

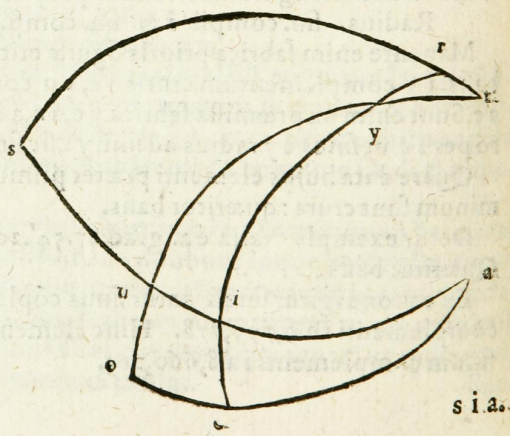
5. Radius est ad sinum complementi cruris, ut sinus anguli dicto cruri non oppositi ad sinum complementi reliqui anguli. 2. theor. Gebri. 18. p. 4. Reg.

Sic in triangulo nostro proportionales sunt

Rad. sin. comp. i e. sin. ang. i. sin. comp. a.

Rad. sin. comp. e a. sin. ang. a. sin. comp. i.

Manente enim trianguli nostri fabrica polo i describat maximus circulus s r. jam i a per polū secet s r, erit angulus s rectus. Sed & angulus u ex præmissa fabrica rectus est. quare si u y concurrat cum s r in r. erit r polus circuli



s i a.

si a. & t s, tu fient quadrantes. Et cum i y secet etiam circulum s t per polum: fient anguli ad r recti & r i quadrans.

jam per 2 e. ut sinus arcus r i hoc est radius ad sinum arcus i y complementi cruris i e sic sinus s r, hoc est anguli ad i. ex fabrica & 4 e 12. ad sinum arcus y u, hoc est complementi anguli a.

Eodē modo res patebit de crure e a & angulis in basi obliquis.

Exempli jam loco detur crus a e grad. 27.54'.20". & angulus a. gr. 23.28'. Quæritur angulus i.

Sinus complementi cruris ex canone datur 8,837,203.

Sinus anguli a est 3,982,155.

Ergo sinus complementi anguli i invenietur 3,519,111.

Com. a e. sin. ang. a. sin. com. ang. i.
10,000,000. 8,837,203. 3,982,155. 3,519,111

Sinui invento ex canone debetur peripheria grad. 20.36'.15".
Ejus ergo complementum gr. 69.23'.45". est pro angulo quæsito.

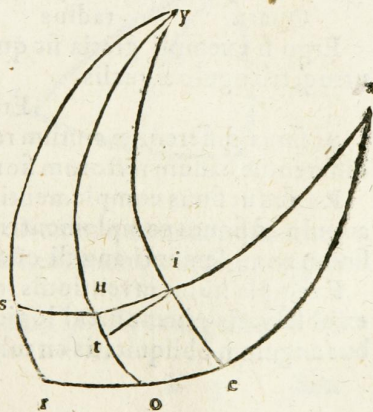
Et in rectangulis

6. Si æquentur angulis duobus acutis, sed basibus rectorum sint inæqualia: erit ut sinus differentie crurum æqualium & rectorum ad sinum differentie basium, sic planus sinuum complementorum crurum æqualibus oppositorum ad planum radii atq. sinus complementi anguli æqualis. 1.p.5. Regiom.

Sint enim duo triangula rectangula a e i. a o u æqualia angulo acuto ad a. Sed basis recti u a major basi i a. Concurrant jam crura perpendicularia i e, u o in y. ubi per 18 e 12 polus est circuli a o.

Rursus per polos maximus circulus y s r secet & a s & a r rectè secabit per 16 e 12. & s r determinabit quantitatem anguli

Z. 2 guli



guli a. & cum r y sit quadrans erit s y complementum anguli a. in utroq; triangulo æqualis: jam sit arcus perpendicularis i t.

Erit per 2 e. primo: ut sinus y u complementi u o cruris oppositi angulo æquali in uno triangulo ad sinum arcus y s complementi anguli æquales: sic sinus i u differentię basiū ad sinū i c.

Secundo: ut sinus y i complementi cruris oppositi angulo æquali in altero triangulo ad sinum arcus y e, hoc est ad radium. Est enim y e quadrans: sic sinus arcus i t ad sinum arcus o e differentię crurum rectorum angulorum & æqualium.

ut hic oculis subiecta vides.

Sin. y u.	sin. y s.	sin. i u.	sin. i t.
Sin. y i.	Rad.	sin. i t.	sin. o e.

Ergo ex arithmetica proportionum multiplicatione, cum termini secundarum rationum heterologi sint æquales: erit ut factus ab sinu y u per sinum y i ad factum ab sinu y s per radium sic sinus i u ad sinum o e. Quod propositio continebat.

Hinc in triangulis rectangulis calculus quidam est in primis facilis: pro inventione unius quinq; istorum terminorum præter radium.

Nam ex terminis hic positis apparent hi termini proportionales.

Sin. y i.	sin. y u.	sin. y s.	Quart.
Quart.	radius	sin. i u.	sin. o e.

Ergo si exempli gratia sit quærendus angulus ille ad a. in utroq; triangulo æqualis.

Erit

ut sinus differentię crurum rectorum ac æqualium ad sinum differentię basiū rectorum sic radius ad quartum aliquem.

Rursus ut sinus complementi majoris cruris oppositi æquali angulo ad sinum complementi minoris sic quartus inventus ad sinum complementi anguli quæsit.

Exempla hujus inventionis invenies apud Astronomos: qui ex observatis phænomeni lōgitudinis ac latitudinis locis duobus angulum obliquitatis circuli phænomeni ad Zodiacum inquirunt.

quirunt. ut si sit notata latitudo cometae & i e & u o, & ex longi-
tudinibus sit nota differentia hoc est o e. Ex calculo etiam nota
differentia i u (nempe ex angulo u y i & complementis latitudi-
num ut inferior calculus docebit) inveniatur hoc ratiocinio an-
gulus a. qui est dictae obliquitatis.

Regiomontanus plura hinc deducit theoremata libro quin-
to. quæ illic legi possunt. Quæ inde est inventio: eam arbitror ex
hoc calculo esse faciliorem. Quod si ejusmodi theoremata col-
ligenda sint: collectionis finis nunquam fuerit. Quis enim eo-
rum ultimum inveniet?

Et in obliquangulo.

7. Sinus angulorum sinibus oppositorum laterum dire-
ctæ sunt proportionales. 17 p. 4. Regiom.

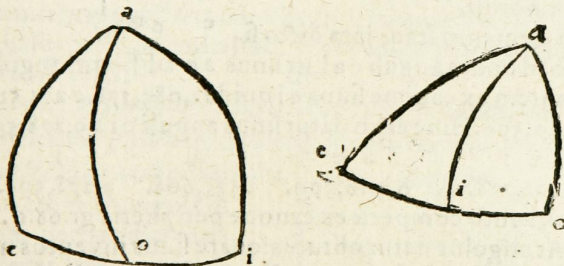
Esto triangulum obliquangulum a e i.

Erunt proportionales

Sin. an. e. sin. an. i. sin. a i. sin. a e.

Sin. an. e. sin. an. a. sin. a i. sin. e i.

Descendat enim perpendicularis ab angulo a in basin e i. fient
duo triangula e o a, i o a rectangula ad o. jam per 3 e. Ra-



dius, hoc est sinus anguli o. (Anguli enim o mensura quadrans
est, & quadrantis sinus radius est) est ad sinum e a ut sinus anguli
e ad sinum a o.

Et rursus ut sinus anguli o ad sinum a i, sic sinus anguli a i o ad
sinum a o.

Z 3 Sin.

Sin. an. o. sin. a e. sin. an. e. sin. a o.

Sin. an. o. sin. a i. sin. an. i. sin. a o.

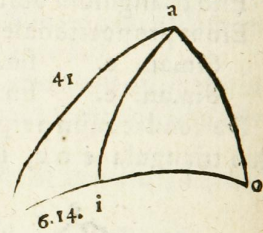
jam ex proprietate proportionis factus ex sinu anguli o in a o equatur facto à sinu a e per sinum ang. e. itemq; facto à sinu a i per sinum anguli i. Et proinde facti hi sibi æquantur itaque per eandem proprietatem ut sinus a e ad sinum a i, sic sinus anguli i, ad sinum anguli e. Eadem res in reliquis angulis fuerit.

Et licet hinc

8. *Dati anguli dato crure ac basi, angulum cruri oppositum invenire si modo obtusus ne sit futurus an acutus præsciveris.* 29. 30. p. 4. *Regiom.*

Exempli gratia sumamus exemplū Thaddæi Hagecii ex dilexi sua de nova ætheria stella: habet aut id capite istius scripti 13.

Sit angulus e a i gr. 8. 56. & e i sit gr. 6. 14. atq; a e sit gr. 41. Hæc enim data illic sunt. & apud Tychonem inscripto de eadem re. Quæritur angulus e i a qui obtusus erit. id enim ex prima inspectione cœlestis illius civitatis patere potuit.



Ex illo elemento itaq; jam dicto sinus e i est ad sinum anguli e a i, ut sinus a e ad sinum anguli a i e. Dantur autem ex canone sinus e i quidē 1,085,778. e a i 1,535,608. & a e 6,560,590. Hinc ergo datur sinus anguli e i a 9,278,595.

e i a e a i
1,085,778. 6,560,590. 1,535,608. 9,278,595.

Sinui invento competit ex canone peripheria gr. 68. 6'. & paulo ultra. At angulus datur obtusus: quare sinus inventus non erit anguli acuti, sed obtusi nempe reliqui 68. 6. de 180, hoc est 111. 54'. ferè Erit ergo angulus e i a gr. 111. 54'. Vides ergo necesse esse ut constet sit ne angulus obtusus aut acutus quem inveniendum proponis. Anceps enim est & dubium triangulum prout in planis quoq; diximus: & eadem hic ratio est.

Atq;

Atq; illud est quod Regiomontanus ad 29.p.4.admonet: Et à Copernico omiffum P.Nonius in observationum regulis & instrumentis ægre fert.

Et

9. Datorum angulorum data unius basi reliqui basin invenire: si quadrante major nec ne ea fit constiterit.

32.p.4.Regiom.

ut retenta præmissa trianguli mensura detur angulus a. detur angulus i. & detur a e. Quæritur e i. Ejus sinus invenietur 1,085,778.ut mutatis terminis præmissi sic patet.

Ang. i	a	a e	e i
9,278,595.	1,535,608.	6,560,590.	1,085,778.

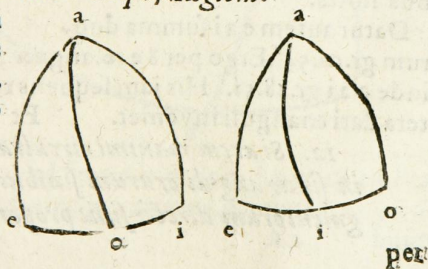
jam sinui invento responder arcus gr.6,14'. Sed & arcus grad. 173.46'. per 8 e 5. at utro basin definiam? Certe id una dari oportet, quia calculus id non invenit: quemadmodū ex iis patet quæ supra de triangulis rectangulis monui: si obliquangulum ad rectangula per perpendicularem reducas. Et id est quod P.Nonius in 12.theor.14. capitis Copernici desiderat: quod tamen in Regiom.ad 32.p.4.tulit.

Et hinc etiam, ut obiter hoc addam, pender praxis 5 & 6. p.5. Regiom. nempe ut datis angulis cum summa aut differentia basium, bases ipsæ inveniantur: si postulata planorum in consilium adhibueris.

Et

10. Si perpendicularis secat basin: sinus angulorum verticalium sinibus complementorum angulorum in basi directe sunt proportionales. 20.p.4.Regiom.

Esto enim triangulum a e i. jam perpendicularis ex a. secet basin e i in o. Dico sinum anguli a o esse ad sinum anguli o a i, ut est sinus complementi anguli e ad sinum complementi anguli i. Est enim



per 5. ut sinus anguli e a o ad sinum complementi anguli e, sic radius ad sinum complementi a o.

At ut radius ad sinum complementi a o, sic sinus anguli o a i ad sinum complementi anguli i.

Ergo, per æquatam rationem, ut sinus anguli e a o ad sinum complementi anguli e, sic sinus anguli o a i ad sinum complementi anguli i.

Hinc patet

11. *Discretio unius anguli, in triangulo datorum angulorum, in verticales perpendicularem e dicto angulo in basin factos. 33.p.4.Region.*

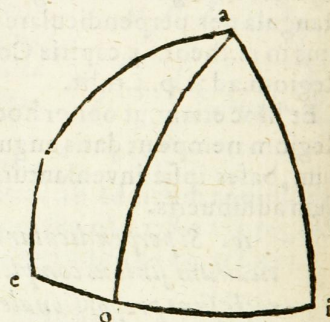
Datur enim hic summa duorum arcuum, nempe duorum verticalium angulorum itemque ratio sinuum ipsorum vel sinuum complementorum angulorum in basi ratio. unde per 8 e 10. utrumque angulorum verticalium secerner.

Est enim trianguli e a i angulus e a i gr. 111. 54. at angulus a e i gr. 8. 50. angulus demum a i e gr. 61. 18'. jam cadat perpendicularis a o. ratio sinus anguli e a o ad sinum anguli o a i est ratio sinus compl. anguli e ad sinum compl. anguli i. Quare ex canone sinuum dabitur ut 98,814 ad 48,022. resectis scilicet posteriorib. duabus notis.

Datur autem e a i summa duorum gr. 111. 54'. Ergo per 8 e 10. angulus e a o erit gr. 83 & 3'. & proinde o a i gr. 28. 51. His jam sequens rectangulorum calculus latera dati trianguli inveniet. Et

12. *Si arcus maximi circuli ab angulo bisecet angulum: in sinus anguli crurum sinibus conterminorum basis segmentorum directe sunt proportionales. 7.p.5.Reg.*

ut in



ut in præmissa figura si a o bifecet angulum e a i. Erunt per 6 e. termini proportionales

Sin. a e. sin. e o. sin. ang. o. sin. ang. a.

Sin. ang. o. sin. ang. a. sin. a i. sin. o i.

Ergo ex æqua ratione sunt proportionales

Sin. a e. sin. e o. sin. a i. sin. o i.

Hinc licet angulum verticis bifecare.

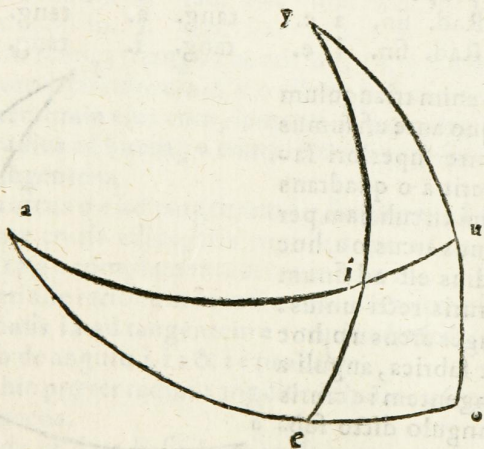
Atq; sic confectarium unum Ptolemaici theorematidis valde secundum habuimus: sequitur alterum.

13. Secundum sic est: Si maximus sphaera circulus maximum secet, & à secante duo arcus reliquo sint perpendiculares: sinus segmentorum secti à sectionis puncto in perpendiculares tangentibus perpendicularium directe sunt proportionales.

Sit enim circulus secans u a sectus o a. perpendiculares u o. i. e. cōcurrant ergo u o, & e i in y, ubi polus erit circuli o a p 18 e 12. & proinde o y, e y sūt quadrantes maximorum circulorum.

jam per i e ratio sinus o a ad sinū arcus a e, sic è ratione sinus arcus o u ad sinum u y, hoc est per 24 e 5 è ratione tangentis o u ad radium: per rationem sinus arcus y i ad

A a sinum



sinum arcus i e, hoc est, per 24 e 5, per rationem radii ad tangentem i e.

At hæ facientes rationes multiplicatæ inter se, sunt ratio tangentis u o ad tangentem i e. Quare ut tangens u o ad tangentem i e sic sinus a o ad sinum a e.

Tang. o u	Rad.	Sin. o a.	sin. a e.
Rad.	Tang. i e.		

Atq; illud est quod Erasmus Rheinholdus in tabulis suis directionum p. 8 usum canonis secundi etiam conspici in tractatione sphaericorum triangulorum ait: quoties nimirum accidat ut duo concurrant sinus, quorum arcus simul uni quadranti æquales sint.

Itaq; in triangulo rectangulo.

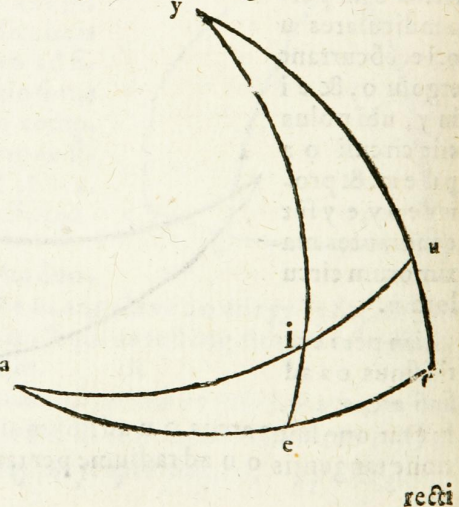
14. Radius est ad sinum cruris, ut tangens anguli ad tangentem cruris subtensi.

Hic proportionales sunt termini

Rad. sin. a e.	tang. a.	tang. i e.
Rad. sin. i e.	tang. i.	tang. a e.

Esto enim triangulum i e a. quo ante usi sumus manente superiori fabrica: erit a o quadrans maximi circuli. jam per 13 e. sinus arcus o a, hoc est radius est ad sinum a e cruris recti unius. ut tangēs arcus u o, hoc est ex fabrica, anguli a ad tangentem i e cruris recti angulo dicto subtensi.

Quamobrem dantur hic præter radium crus



recti & angulus adjacens: quæritur crus recti angulo dato oppositum.

Sit exempli gratia datum crus e a gr. 27.54'.20". & angulus a gr. 23.28'. Quæritur crus i e. Est ergo ut radius ad sinum e a, sic tangens anguli a ad tangentem cruris i e.

Et cum ex canone detur sinus e a 4,680,155. & tangens anguli a 4,341,209: hinc dabitur tangens i e. 2,031,753.

Sin. e a.	tan. a.	tan. i e.
10,000,000.	4,680,155.	4,341,209.
		2,031,753.

Tangenti inventæ in canone responderet arcus gr. 11.29'.5". pro arcu i e. Quadrante enim crus minus est per 13 e 13.

Et

15. Radius est ad sinum complementi anguli, ut tangens basis ad tangentem cruris dicto angulo adjacentis.

Sic in triangulo nostro proportionales termini sunt

Rad.	sin. com. an.	a.	tan.	i a.	tan.	a e.
Rad.	sin. com. an.	i.	tan.	i a.	tan.	i e.

Manente enim fabrica trianguli patuit o y, u a, o a esse quadrantes maximorum circulorum: & u o esse anguli a mensuram proindeq; u y mensuram ejus complementi. per 13. e. ergo ut sinus o y, hoc est radius ad sinum y u complementi anguli a. sic tangens e o ad i u tangentem.

At ut tangens arcus o e ad tangentem i u, sic tangens i a basis ad tangentem a e cruris adjacentis angulo a. per 26 e 5. Sunt enim ex fabrica i a, a e complementa arcuum i u, o e.

Ergo ex æquatione rationum ut radius ad sinum compl. anguli a. sic tangens basis i a ad tangentem e a cruris adjacentis.

Eodem modo de angulo i. i a & i e probabit.

Dantur ergo hic præter radium angulus & basis. Quæritur crus angulo adjacens.

Exempli gratia sit data basis i a gr. 30. & angulus a. & cupias investigare e a.

Sinus compl. anguli a. est 9,172,920. tangens aut i a 5,773,502.
Aa 2 Hinc

Hinc ergo invenitur tangense a 5,295,987.

Sin.com. a. tan. i a. tan. e a.

10,000,000. 9,172,920. 5,773,502. 5,295,987.

Ergo ex canone tangentium crus ipsum invenitur gr. 27.54'.20". minus scilicet quadrante. Quia enim basis datur minor quadrante per 14 e 13. crura erunt similiter inæqualia quadranti. at unum i e est minus quadrante. Nam ex thesi angulus oppositus a est acutus. Ergo per 13 e 13 i e minus quadrante. Et proinde e a minus quadrante.

Et

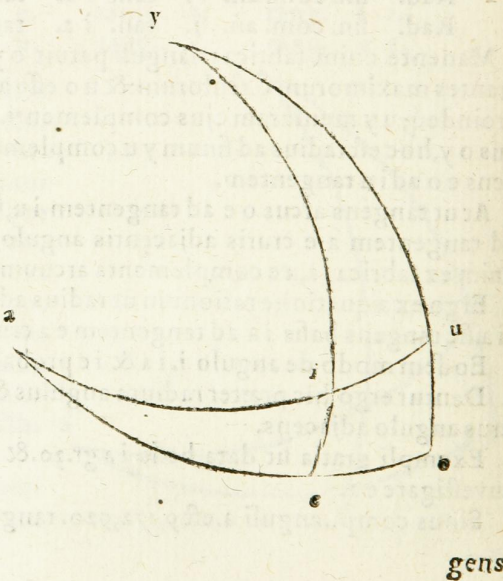
16. Radius est ad sinum complementi anguli, ut tangens complementi cruris adjacentis ad tangentem complementi basis.

Hic ergo termini sunt proportionales:

Rad. sin.compl.an. a. tang.com. e a. tang.com. ia.

Rad. sin.compl.an. i. tang.com. i e. tang.com. ia.

Manente enim diagrammate & fabrica nostri trianguli o y, u a, o a sunt quadrantes et o u mensura anguli a. Ergo u y erit complementum anguli a. & o e complementum cruris e a. itemq; u i complementum basis i a. Sed cum ex fabrica i u, e o sint in y o perpendiculares p 13 e. est ut sinus o y hoc est radius ad sinum y u sic tan-



gens

gens o e ad tangentem i u. Sic de angulo i & i e res constabit.

Data ergo huius elementi sunt angulus & crus adjacens: quæritur basis.

Exempli gratia detur e a gr. 27. 54'. 20". & angulus a. gr. 23. 28'. quæritur basis i a.

Ex canone ergo sinuum dabitur sinus comp. ang. a. 9,172,920. & ex canone tangentium tangens compl. e a. 18,882,289.

Ergo hinc dabitur tangens compl. i a basis 17,320,572.

Sin. compl. a. tang. comp. e a. tang. com. i a.
10,000,000. 9,172,920. 18,882,289. 17,320,572.

Ergo ex canone tangentium datur complementum basis gr. 60. & proin basis ipsa i a gr. 30. Nam cum e a sit minor quadrante erit ang. i. acutus & proinde per 15 e 13 basis minor quadrante.

Et

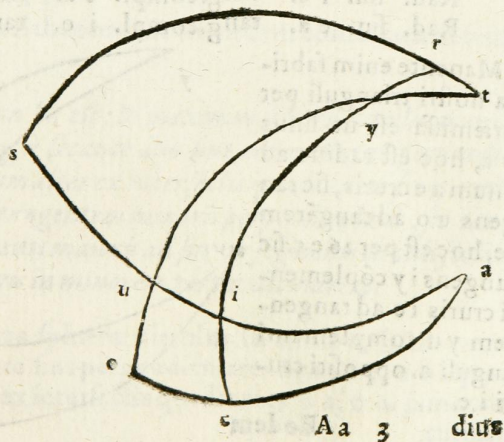
17. Radius est ad sinum complementi basis, ut tangens anguli ad tangentem complementi reliqui anguli.

Hic ergo in nostro triangulo termini proportionales sunt isti.

Rad. sin. compl. i a. tang. a. tang. compl. i.

Rad. sin. compl. i a. tang. i. tang. compl. a.

Repetita. n. fabri-
ca trianguli quæ
5 e fuit. patuit il-
lic i s, a u, u r, s
t esse quadrantes,
& u i esse com-
plementum basis.
s r mensuram an-
guli i. & u y com-
plementum angu-
lia. & r s, y u in s i
esse perpendicu-
lares. itaq; per 13 e.
sinus s i, hoc est ra-



Aa 3 dius

dius est ad sinum i u ut tangens r s ad tangentem arcus y u.

Data ergo elementi hujus præter radium sunt basis, & angulus in basi unus. Quæritur reliquus angulus.

Exempli gratia detur basis i a gr.30. detur angulus a gr.23.28'.
Quæritur angulus i.

Ex canone itaq; sinuum datur sinus compl. basis 8,660,254.

Et ex canone tangentium datur tangens anguli a. 4,341,209.

Hinc ergo dabitur tangens complementi anguli i. 3,752,597.

Sin.comp. i a. tang. a. tang.comp. i.

10,000,000.	8,660,354.	4,341,209.	3,759,597.
-------------	------------	------------	------------

Ergo ex canone tangentium datur complementum anguli i
gr. 20. 36. 15". & proinde angulus ipse grad. 69. 23. 45". minor sci
licet quadrante. Quia enim basis ex thesi minor est quadrante:
anguli in basi similiter inæquales erunt quadranti per 15 e 13. at
ex thesi unus datur acutus. Ergo & reliquus acutus erit.

Et

18. Radius est ad sinum cruris, ut tangens complementi
reliqui cruris ad tangentem complementi anguli oppositi.

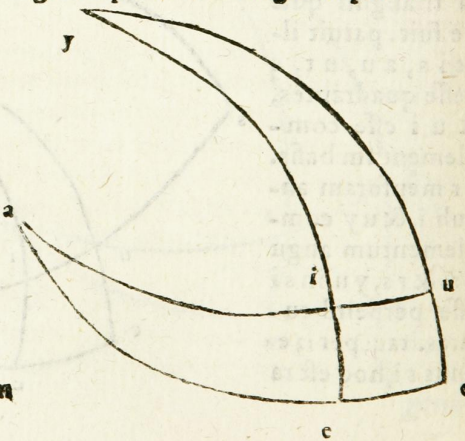
Hic ergo termini proportionales trianguli nostri sunt.

Rad. fin. i e. tang.compl. e a. tang.compl. i.

Rad. fin. e a. tang.compl. i e. tang.compl. a.

Manente enim fabri-
ca nostri trianguli per
præmissa est ut sinus
o a, hoc est radius ad
sinum a e cruris, sic tan-
gens u o ad tangētem
re, hoc est per 26 e 5. sic
tangens i y cōplemen-
ti cruris i e ad tangen-
tem y u complementi
anguli a. oppositi cru-
ris i e.

Eodem



Eodem modo de angulo i constabit ex i e & e a.

Data itaq; hujus theorematissunt præter primum aureæ regulæ terminum crura duo. & quæritur angulus alteri crurum oppositus.

Exempli gratia. Detur i e gr. 11. 29'. 5". at e a gr. 27. 54'. 20".

Quæratursinus a.

Ex canone itaq; sinuum datur sinus e a. 4,680,155.

Et ex canone tangentium depromitur tangens complementi i e. 49,218,748.

Hinc ex præmissoelemento dabitur tangens complementi anguli a. 23,035,137.

Sin.	e a.	tan.com.	i e.	tan.com	a.
10,000,000.	4,680,155.	49,218,748.		23,035,137.	

Ergo complementum anguli ex canone tangentium datur gr. 66. 32'. & proinde angulus ipse a gr. 23. 28'. minor scilicet quadrante per 14 e 13. crura enim recti minora sigillatim quadrante dantur.

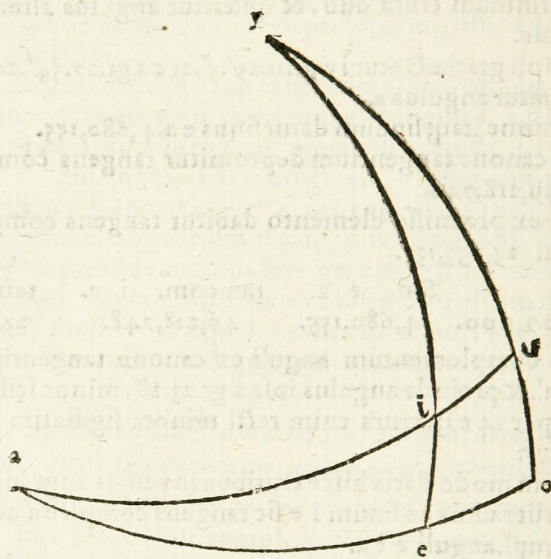
Eodem modo datishisecruribus invenies angulum i.

Nam ut radius ad sinum i e sic tangens compl. e a ad tangentem compl. anguli e i a.

Atq; sic è Ptolemæi theoremate secundum consuetarium fuit: Sequitur tertium.

19. Tertium sic est: Si maximus sphaerae circulus maximum secet, atq; à secante duo sint arcus reliquo perpendiculares, quorum alter ex intersectis quadrantes secet: erit ut radius ad tangentem minoris perpendicularis, sic tangens complementi majoris ad sinum segmenti circuli secti à puncto sectionis in minorem perpendicularem.

Sit enim maximus sphaerae circulus secans u a, sectus vero o a: atque à secante sint perpendiculares arcus i e, u o: quorum alter u o secet ex intersectis quadrantes u a, o a. jam concurrant



currant perpendiculares erit in y polus circuli a o & y o. y e quadrantes, ut in prioribus fabricis etiam innotuit. jam sic absoluta fabrica per i e. ratio sinus y i ad sinum arcus i e, hoc est per 24 e 5. ratio radii ad tangentem i e fit è ratione sinus arcus y u ad sinum arcus u o, hoc est per dictum 24 e 5. ratione tangentis y u ad radium per rationem sinus arcus o a, hoc est ex thesi, radii ad sinum arcus a e. Atqui hæc multiplicata est ratio tangentis y u ad sinum a e. ut hic vides.

Facientes.			Facta.	
Sin. y u.	tan. y u.	Rad.	Sin. y i.	ad sin. i e.
hoc est			id est	
Sin. u o.	Rad.	sin. a e.	Rad.	ad tang. i e.
				Ergo

Ergo radii
tangens y
secus circuli a

20. R.
menti an

Ergo in nost

Rad. tan

Rad. tan

Manente eni

y e quadrantes

quadrantes. C

quadrantes u a,

tangentem i e u

lun, hoc est ex fi

Eodem modo de

Data itaq; hui

gulus oppositus

Exempli causa

tan. 28. Quæ

Ex tangentiū in

tan. compl

Ergo ex præm

4,680,137.

10,000,000.

Itaq; ex canon

recesse est si ne cr

Nam fieri potest u

sin. & rursus quad

Elemento hoc

Et Erasmus Rhe

pro utitur in inq

dimensionali.

Ergo radius est ad tangentem i e minoris perpendicularis ut tangens y n. complementi majoris ad sinum a e arcus nimirum secti circuli ab a pūcto sectionis in minorem perpendicularem. Itaq; in triangulo rectangulo.

20. Radius est ad tangentem cruris, ut tangens complementi anguli oppositi ad sinum reliqui cruris.

Ergo in nostro triangulo termini proportionales sunt

Rad. tang. i e. tang.comp. a. sin. e a.

Rad. tang. e a. tang.comp. i. sin. i e.

Manente enim rursus fabrica superioris trianguli erunt y o. y e quadrantes & u y complementum anguli a. & a u, a o sunt quadrantes. Cum ergo perpendiculares sint i e, u o & u o secet quadrantes u a, o a erit per præmissum elementum, Radius ad tangentem i e ut tangens u y complementi majoris perpendicularis, hoc est ex fabrica compl. anguli a. ad sinū a e cruris reliqui. Eodem modo de e a, & angulo i res constat.

Data itaq; hujus propositionis sunt præter radium crus & angulus oppositus: quæritur crus reliquum.

Exempli causa: sit datum crus i e gr. 11.29'. 5. itemq; angulus a gr. 23.28'. Quæritur crus reliquum e a.

Ex tangentiu itaq; canone datur tangens cruris i e 2,031,745. & tangens compl. anguli a. 23,035,062.

Ergo ex præmissis elemento invenietur sinus cruris e a. 4,680,137.

Tan. i e.	tan.com. a.	sin. e a.
10,000,000.	2,031,745.	23,035,062.
		4,680,137.

Itaq; ex canone sinuum datur e a gr. 27.54'. 20". Sed hic dari necesse est sit'ne crus inveniendum quadrante majus aut minus. Nam fieri potest ut crure minore quadrante crus alterum majus sit: & rursus quadrante minus sit: pro magnitudine basis.

Elemento hoc Regiomont. ut alibi sic & 4 p. tabul. direct. Et Erasmus Rheinholdus in suis tabulis direct. 21. 23. 24. præcepto utitur in inquirenda fixarum ascensione recta & differentia ascensionali.

Bb Et

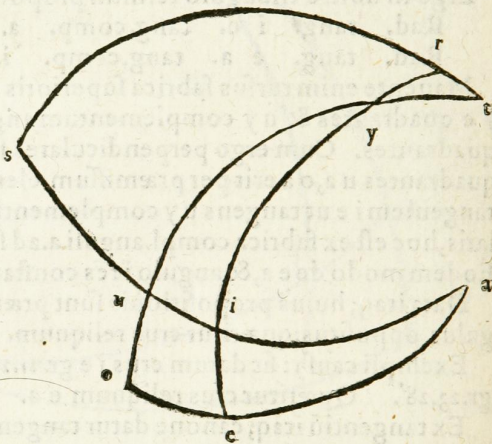
Et

21. Radius est ad tangentem complementi anguli, ut tangens complementi reliqui ad sinum complementi basis.

Hic termini proportionales sunt in triangulo.

Rad. tan.com. a. tan.com. i. sin.com. i a.

Reperita fabrica trianguli superioris se fiat quadrantes ut ante dictum. Et quia r i, si se secant & perpendiculares sunt y u & r s secans quadrantes r i, s i. erit ut radius ad tangentem y u complementi u o, hoc est anguli a , Sic tangens r t complementi s r, hoc est anguli i ad sinum i u complementi basis.



Data ergo hic duo anguli. Quæritur basis.

Exempli loco detur angulus a gr. 23.28'. & ang. i . gr. 69.23'. 45". Quæritur i a.

Ex canone ergo tangentium datur tangens complementi anguli a . 23,035,062.

Et tangens complementi anguli i . 3,759,583.

Ergo ex canone hujus elementi sinus complementi i a invenitur 8,660,223.

Tan.com. a.	tan.com. i.	sin.com. i a.
10,000,000.	23,035,062.	3,759,583.
		8,660,223.

Et proinde ex canone sinuum invenitur complementum basis.

sis grad. 60. & ita basis gr. 30. minor quadrante per 15 e 13.
Hinc jam sequetur quartum generale confectarium.

Et

22. Radius est ad tangentem complementi basis, ut tan-
gens cruris ad sinum complementi anguli adjacentis.

Termini proportionales in triangulo sunt

Rad. tan.comp. i a. tan. i e. sin.com. i.

Rad. tan.comp. i a. tan. e a. sin.com. a.

Repetita enim trianguli propositi fabrica erit per 19 e.

ut radius ad tan-
gentem i u comple-
menti basis sic tan-
gens a e cruris ad
sinum u y comple-
menti anguli a ad-
jacentis cruri e a.

Sunt enim a se-
cante e y. perpen-
diculares i u, e o. &
e o secatur ab interse-
ctis quadrantes. &
e a est complemen-
tum o e. ut ex fa-
brica hactenus sæ-
pe allata pater.

Eodem modo res
pater de i e & i.

Data ergo hic sunt cum radio basis & crus. Quæritur angu-
lus cruri dato adjacens.

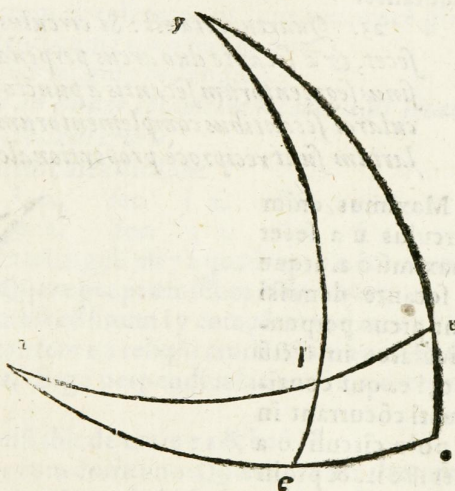
Exemplū rursus sit illud. detur i a basis gr. 30. & i e gr. 11. 29'. 5".

Quæritur hinc angulus i.

Ex canone itaq; tangentium datur tangens i e 2,031,745.

Itemq; tangens complementi basis 17,320,508.

Bb 2 Atq;



Atq; hinc per expositum elementum sinus complementi anguli i invenietur 3,519,079.

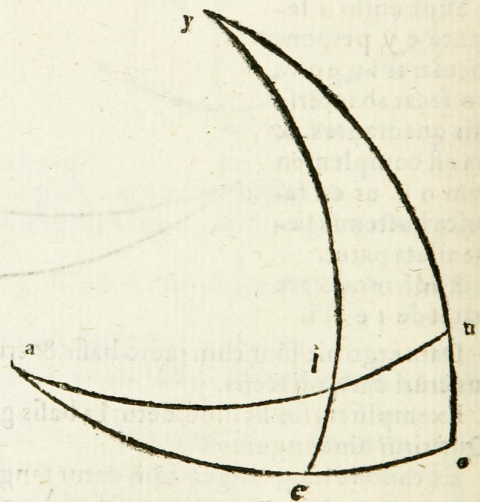
Tan.com. i a.	tan. i e.	fin.com. i .
10,000,000.	17,320,508.	2,031,745.
		3,519,079.

Ergo ex canone sinuum dabitur complementum anguli i gr. 20 36' 15". & proinde ipse angulus i gr. 69. 23'. 45". Et est quadrante minor. Quia enim basis est minor quadrante: per 14 e 13 crurumq; similiter inæquale est quadranti. Jam vero ex thesi crurum i e est minus quadrante. Ergo & reliquum. & proinde per 13 e 13 angulus ab e a subtenfus acutus est, quia crurum est minus quadrante.

23. *Quartum ita est: Si circulus maximus maximum secet, & a secante duo arcus perpendiculares reliquo sint: sinus segmentorum secantis a puncto sectionis in perpendiculares secantibus complementorum arcuum perpendicularem sunt reciproce proportionales.*

Maximus enim circulus $u a$ secet maximū $o a$. atque a secante demissi sint arcus perpendiculares in sectū $u o$, i e. qui continuati cōcurrant in y polo circuli $o a$ per 18 e 12. & proinde fient quadrantes $o y$, $e y$.

Jam per 1 e. Ratio sinus arcus $u a$ ad sinum arcus $a i$ fit e ratione sinus arcus $u o$ ad sinum arcus



u y, hoc

u y, hoc est per 28 e 5 è ratione radii ad secantem u y. per rationem sinus arcus y e ad sinum arcus e i, hoc est, ex dicto elemento, per rationem secantis y i ad radium.

Ac hæ multiplicatæ sunt ratio secantis y i ad secantem u y.

Rad. Sec. y i. fin. u a. fin. a i.
Sec. u y. Rad.

Ergo ut secans y i ad secantem u y, sic sinus u a ad sinum a i.

Possit quoque elementum hoc ex 2 e deduci. Nam ut sinus u a ad sinum a i sic sinus u o ad sinum i e.

At ut sinus u o ad sinum i e sic secans y i ad secantem u y. p 29 e 5.

Ergo ut sinus u a ad sinum a i sic secans y i ad secantem u y. hoc est sinus segmentorum circuli secantis sunt reciprocè proportionales complementorum i e, u o secantibus.

Itaq; in triangulo rectangulo.

24. Radius est ad sinum complementi cruris, ut secans basis ad secantem reliqui cruris.

Ergo termini proportionales hic sunt

Rad. sin.com. i e. sec. i a. sec. e a.
Rad. sin.com. e a. sec. i a. sec. i e.

Reperita enim fabrica trianguli est y e quadrans, i u & e o perpendiculares ad o y. Quare per præmissum elementum:

Sinus e y, hoc est radius est ad sinum i y complementi cruris i e: ut secans i a basis ad secantem e a reliqui cruris. Sunt enim ex fabrica u a, o a quadrantes. Ergo perpendicularium i u, e o complementa sunt i a, e a.

Eodem modo res constabit de crure e a & basi e.

Dantur ergo hic basis cum crure uno: Quæritur crus alterum.

Exempli jam loco sit in triangulo basis i a grad. 30. & crus i e gr. 11. 29'. 5".

Ex canone ergo secantiū dabitur secans i a quidē 11,547,004. at sinus com. i e 9,799,778.

Hinc per dictum elementum secans cruris e a 11,315,807.

Sin.com. i e.	sec. i a.	sec. e a.
10,000,000.	9,799,778.	11,547,004.
		11,315,807.
	Bb 3	Ergo

Ergo ex canone secantium arcus respondens inventæ secanti nempe gr. 27, 54', 20" est pro crure e a.

Quod minus est quadrante: quia cū basis eo minor sit & cruris e etiam per 14 e 13 cruris reliquum e a eo minus erit.

Et

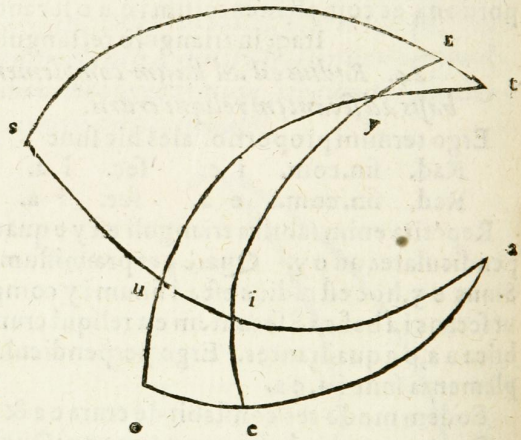
25. Radius est ad sinum anguli, ut secans anguli reliqui ad secantem cruris oppositi.

Hic termini proportionales sunt:

Rad. sin. ang. a. secans an. i. secans e a.

Rad. sin. ang. i. secans an. a. secans i e.

Reperito enim triangulo & fabrica s e circulus maximus t o maximum r e secat, & à secante arcus perpendiculares reliquo sunt r r & o e. Nam quia ex fabrica polus circuli s est in i, & proinde i r secat circum s t per polum & rectè secat per 16 e 12. Et anguli ad e ex thesi recti



sunt. Ergo ex fonte horum confectariorum, ut sinus o y, hoc est radius (Est enim o y quadrans) ad sinum y t, Sic secans s r complementi scilicet minoris perpendicularis r t. (Nam ex fabrica & 17 e 12 s t est quadrans) ad secantem e a. complementi majoris perpendicularis.

At y t æquatur ipsi u o. cum enim o y, & u t sint quadrantes maximi circuli & proinde æquales, ablato communi arcu u y. relinquentur

quantur æquales arcus. Et u o est mensura anguli a. Et s r est mensura anguli i. atq; e a crus angulo i oppositum.

Quare ut radius ad sinum anguli a sic secans anguli i ad secantem e a cruris oppositi. Simili modo res de reliquo crure i e patebit.

Dantur ergo in hoc elemento præter radium duo anguli: quæritur crus recti alteri datorum oppositum.

Exempli loco sit iterum angulus a. grad. 23. 28'. angulus vero i grad. 69. 23'. 45". Quæritur jam crus verbi gratia i e.

Ex canone ergo sinuum datur sinus anguli i. 9,360,337.

Et ex canone secantium innotescit secas anguli a. 10,901,656.

Hinc elementum jam dictum inveniet secantem i e. 10,204,317.

Sin. i.	sec. a.	sec. i e.
10,000,000.	9,360,337.	10,901,656.
		10,204,317.

Cui ex canone secantium responderet arcus grad. 11. 29'. 5". quadrante minor per 15 e 13 pro crure i e.

Et

26. Radius est ad sinum anguli ut secans complementi cruris oppositi ad secantem complementi basis.

Termini proportionales hujus elementi sic sunt:

Rad. sin. an. a. sec. com. i e. sec. com. i a.

Rad. sin. an. i. sec. com. e a. sec. com. i a.

Manente enim præmissi elementi diagrammate. Quia maximus circulus u t maximum s t secat, atque à secante sunt perpendiculares ex fabrica s u, y r. Erit ut sinus u t, hoc est radius ad sinum y r, hoc est u o, id est anguli a, ut secans y i, hoc est complementi cruris i e. ad secantem i u, hoc est complementi basis.

Eodem quoque modo res se habet in angulo i, & crure opposito e a.

Data ergo hujus elementi sunt præter primum terminum autæ regulæ angulus cum crure opposito: quæritur basis. quæ sit necne quadrante major sciri aut dari oportet ut supra monui.

Exemplo

Exemplo superiori retento fit i e gr. 11. 29'. 5". & angulus a. gr. 23. 28'. Quæritur basis eaq; quadrante minor.

Ex canone itaq; dicti elementi secans compl. basis i a inuenitur 20,000,115.

Sin. a.	sec.com. i e.	sec.com. i a.
10,000,000.	3,982,155.	50,224,350.
		20,000,115.

Cui in canone responder peripheria gr. 60. Ergo i a erit gr. 30.

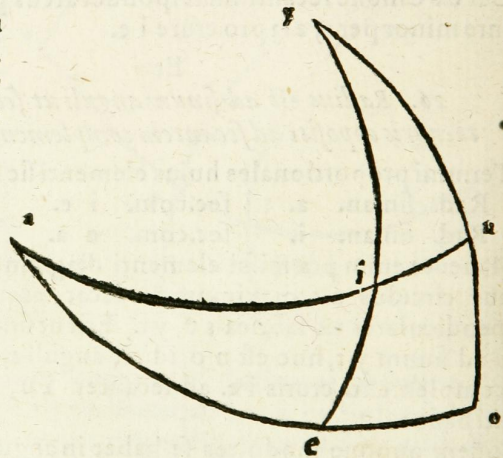
Et

27. Radius est ad sinum basis, ut secans complementi cruris ad secantem complementi anguli oppositi.

Termini analogias hujus elementi sic sunt:

Rad. sin.	i a.	sec.com. i e.	sec.com. a.
Rad. sin.	i a.	sec.com. e a.	sec.com. i.

Maneat enim præmissa triangu li fabrica. Quia hic maximus circulus u a secat maximum o a. atque à secante sunt arcus perpendiculares i e, u o quorû cõple menta sunt y i, y u. Erit ut sinus arcus u a, hoc est radius ad sinum a i basis: sic secans i y comple



menti cruris i e ad secantē y u complementi u o, hoc est anguli a.

Simili modo res pater de e a & angulo i.

Dantur ergo in hoc elemento præter radium crus unum & basis: quæritur angulus cruri oppositus.

Sic

Sic si deturi e gr. 11.29'.5". & basis i a. 30.

Dabitur ex canone sinuum sinus basis 5,000,000.

Et ex canone secantium secans compl. i e. 50,224,350.

Hinc regula hujus elementi invenit secantem compl. angu-
li a. 25,112,175.

Sin. i a.	sec.com. i e.	sec.com. a.
10,000,000.	5,000,000.	50,224,350.
		25,112,175.

Quare angulus ipse ex canone dabitur grad. 23.28'. quadrante
minor per 13 e 13.

Et

28. Radius est ad sinum complementi cruris, ut secans
anguli oppositi ad secantem complementi reliqui anguli.

Termini proportionis hujus theorematissunt isti:

Rad. sin.com. i e. sec.ang. a. sec.com. i.

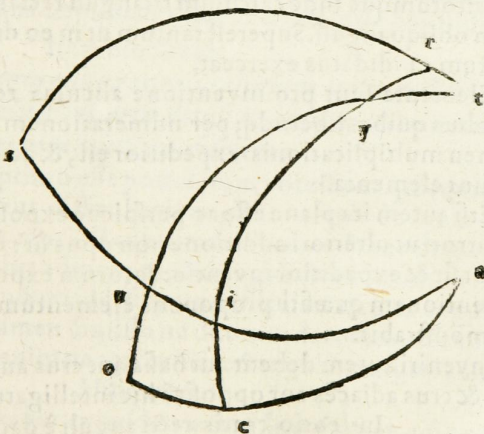
Rad. sin.com. e a. sec.ang. i. sec.com. a.

Reperito enim superiori schemate, quia ex fabrica maximus
circulus i r maxi-
mum i s secat. atq;
à secante sunt per-
pendiculares r s,
yu arcus, quorum
complementa sunt
rt, yt. Erit ut sinus
r i, hoc est radius
ad sinum i y com-
plementi cruris i e,
sic secans y t, hoc
est u o (sunt enim
reliqui equalis uy
de equalibus qua-
drantibus) hoc est
anguli a ad secan-
tem rt complementi s r hoc est anguli i.

Eodem modo veritas probatur in e a & angulo i.

Cc

Data



Data ergo huius elementi sunt crus & angulus oppositus: quæritur angulus obliquorum alter. Si constiterit acutus ne an obtusus existat. id enim calculus non iudicabit ex superioribus: nisi constet de quantitate basis, aut cruris oppositi. Nam crure uno & proinde angulo ei opposito acuto fieri potest ut alter acutus & etiam obtusus sit. per 13 & 14 e 13.

Esto exempli gratia crus ei gr. 11. 29'. 5". & angulus oppositus a. gr. 23. 28'. Quæritur angulus i acutus.

Ex canone sinuum datur sinus compl. i e. 9,799,778.

& ex canone secantium secans anguli a. 10,901,656.

Ergo elementum præsens inveniet secantem complementi anguli i. 10,683,382.

Sin.com. i e.	sec. a.	sec.com. i.
10,000,000.	9,799,778.	10,901,656.
		10,683,382.

Cui in canone secantiū responder gr. 20. 36'. 15". pro cōplemen- to. Ergo angulus erit gr. 69. 23'. 45". Nam ex thesi acutus datur.

Atque hoc modo consuetaria è Ptolemaico elemento habui- mus: totumque inde calculum trianguli rectanguli: etiam quen- dam obliquanguli. Superest tantum ut in eo diligenter se Mathe- matum candidatus exerceat.

Elementa sunt pro inventione alicujus tertii termini datis duobus quibuslibet: idque per numerationem conjunctam. Via tamen multiplicationis expeditior est, & ad eam accommoda- ta sunt elementa.

Et si autem ita plane esse ac perspicue expositū hunc calculum arbitror: ut ulteriori additione non opus sit: Quo tamen prom- ptior sit & expeditior inventio: datorum expositionem & ex iis inventionem quæsitū proponens elementum sequens diatypo- sis monstrabit.

Inveniri autem debent aut basis aut crus aut angulus. Angu- lus & crus adjacēs aut oppositū hic intelligatur ratione quæsitū.

Inventio cruris recti anguli è datis.

- | | |
|------------------------------|-------|
| 1. Basis & angulo opposito. | 3 e. |
| 2. Basis & angulo adjacentē. | 15 e. |

3. Basis

- | | | |
|-----------------------------------|--------------------------------|-------|
| 3. | Basi & crure reliquo. | 24 c. |
| 4. | Crure & angulo opposito. | 14 c. |
| 5. | Crure & angulo adjacente. | 20 c. |
| 6. | Duobus angulis in basi. | 25 c. |
| Inventio basis recti è datis. | | |
| 1. | Recti cruribus. | 4 c. |
| 2. | Angulo & huic crure adjacente. | 16 c. |
| 3. | Angulo & huic crure opposito. | 26 c. |
| 4. | Duobus angulis. | 21 c. |
| Inventio anguli in basi ex datis. | | |
| 1. | Crure opposito & angulo. | 5 c. |
| 2. | Crure adjacente & angulo. | 18 c. |
| 3. | Basi & reliquo angulo. | 17 c. |
| 4. | Basi & crure adjacente. | 22 c. |
| 5. | Basi & crure opposito. | 27 c. |
| 6. | Cruribus. | 18 c. |

Hinc etiam deductus est quidam obliquangulorum calculus ad 8 & 9 e. sed reliquus obliquangulorum etiam inde dependet.

Itaq; hinc licet.

29. Reliquum obliquanguli calculum ita in rectangula duo perpendiculari arcu divisi, ne è tribus datis terminis duorum turbetur noticia, absolvere.

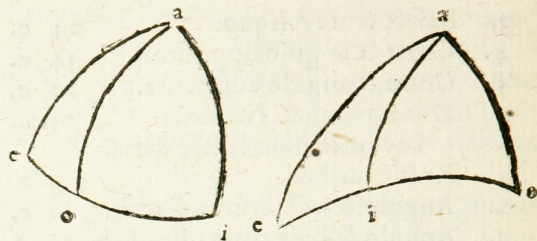
Hoc jure nobis optimo esse postularum potest: nec quicquam habet obscuritatis aut difficultatis cognita calculi doctrina ea quam modo exposuimus. Requiritur tria data: & totidem requirenda ipse calculus admonet: Triangulum oblatum in rectangula est deducendum idq; fit perpendiculari arcu ex angulo aliquo dimisso: ita tamen dimisso ne duorum datorum offenda- tur noticia. Secus enim nec calculus rectanguli trianguli adhi- beri potest.

Hinc ergo

1. Datis duobus angulis una cum latere utriq; adiacen- te reliqua inveniemus. puta latera reliqua & angulum. §1. p. 4. Regiom.

Cc 2 Esto

Esto enim tri-
angulū a e i. cu-
jus anguli duo
sint dati nempe
a & e. cum adja-
centel latere e a.
Sintq; verbi gra-
tia a e gr. 38.26.



angulus a. gr. 38.26. & angulus e gr. 8.56. Ducatur jam ab a per-
pendicularis arcus: qui sive intra cadat, sive extra calculus perin-
de procedit: & calculus hoc docet.

Fiunt ergo hic duo rectangulā e a o, o a i. quorū calculus quæ-
sita in obliquangulo parefacient.

In triangulo ergo rectangulo e a o datur angulus e. datur recti
basis e a. Ergo per 3 e. dabitur perpendicularis a o gr. 5.28' ferè.

Sin. e a.	fin. ang. e.	fin. a o.
10,000,000.	6,202,356.	1,535,608.
		952,439.

Et segmentum basis e o. gr. 38.6.4" per 15 e.

Sin. com. an. e.	tan. e a.	tan. e o.
10,000,000.	9,881,392.	7,906,973.
		7,813,190.

Et per 5 evel aliud aliquod, cum plura hic sint data, angulus
e a o. gr. 83.3'.

Sin. com. e o.	fin. ang. e.	fin. com. a.
10,000,000.	7,879,988.	1,535,608.
		1,210,031.

Quod si jam angulus e a o inventus major sit angulo dato
e a i: perpendicularis cecidit extra triangulum: quod si minor sit
cecidit intra. Atque ut illic subductio dati e a i ab invento relin-
quit angulum o a i rectanguli trianguli reliqui: sic hic cōtra sub-
ductio inventi à dato reliquum facit angulum i a o.

Et cum in præsentī exemplo inventus minor sit eo subducto
de angulo e a i gr. 38.26. relinquitur angulus i a o gr. 28.51.

jam in triangulo i a o rectangulo cum detur a o perpendi-
cularis nempe, itemque angulus i a o per 14 e invenietur crus
io grad. 3.

Sin.

Sin. a o. tan.an. a. tang. i o.
 100,000. 952,439. 5,508,916. 524,690.
 Et hinc ex duobus cruribus per 4 e basis invenitur gr.6.14'.
 Sin.com. i o. fin.com. a o. fin.com. i a.
 1,000,000. 998,630. 995,452. 994,088.
 Vel per 16 e.eodem modo invenietur.

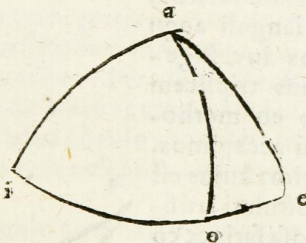
Sin.com. a. tan.com. a o. tan.com. i a.
 10,000,000. 8,758,860. 104,491,055. 91,522,302.
 jam per 5 e angulus a i o invenietur gr.61.18'.

Sin.com. a o. fin.an. a. fin.com. i.
 1,000,000. 995,452. 482,518. 480,324.
 jam itaq; ut respondeatur quæstioni: habemus latus i a ex hoc calculo gr.6.14. & angulum a i e invenimus gr.61.18'.

Quantum autem erit latus e i? Habemus inventa segmenta e o, o i. jam si perpendicularis intra triangulum ceciderit tum summa e o, o i. sui extra differentia est latus e i. Hic quia perpendicularis intra ceciderit summa gr.38. & grad.3. hoc est gr.41. est pro latere quæsito.
 Et.

2. *Datis angulis inveniuntur latera.* 33.p.4. *Regiom.*

ut si trianguli modo dato noti sint anguli. Descendat ab a perpendicularis a o. jam per 11 e. angulus e a o, dabitur itemq; o a i. Quare in triangulo rectangulo e a o. dabitur ex superiori calculo a e, & e o. Rursus in triangulo o a i eadem illa superiora invenient a i & o i. Atque ita duo latera inventa sunt. tertium e i est summa laterum e o, o i. si perpendicularis intra ceciderit. Quæ via est facilissima ut semper intra cadat: quod fiet si anguli duo in basi assumantur iidem specie per 17 e 13. Et



3. *Quæ calculus obliquangulorum superior non invenit hinc scrutabimur.*

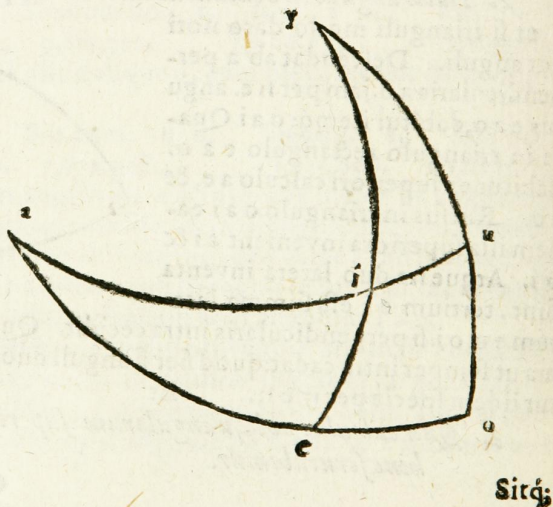
Cc 3 ut fit

ut si detur a & a itemq; angulus e . 8^o e inveniet angulum i . Descendat jam perpendicularis a o . fient rectangula in quibus cum detur illic a e & angulus e . dabitur angulus e o & e o . hic vero cum nota sint a i & angulus i . invenietur angulus i a o & o i . jam ut propositi trianguli angulum e a i , & e i definias: scias casum perpendiculari necesse est ex angulis e & i . & inde summa particularium quaestorum, si intra cecidit: differentia, si extra, pro quaesito est.

Eodem modo si dentur anguli e & i cum latere e a per 9^o dabitur a i . & hinc reliqua ut jam dictum est.

Et sic reliquis casibus hoc praesens postulatum sufficit. Et sic jo. Regiomontanus 28. p. 4. datis cruribus dati anguli reliqua investigat.

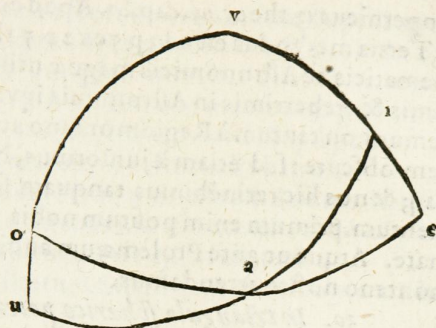
At vero ut datorum laterum trianguli angulos investigemus triplicem ab eo methodum accepimus. Prima hujus est postulati artificiosa satis & compositior quam 4 p 5 exponit. ut si detur triangulum y u i datorum laterum.



Sicq;

Sitque verbi gratia inveniendus angulus y.

jam facto polo in y describatur peripheria maximi circuli o e secans i u ad a. & y u, y i secant huc maximum, recte secabunt per 16 e 12 ac erunt y o, y e quadrantes. & proinde u o, i e complementa laterum y u, y i.



jam quia circulus u a secat maximum o a. & ab u a sunt perpendiculares u o, i e: erit per 2 e sinus u a ad sinum a i, ut sinus u o ad sinum arcus i e. Quare cum ex thesi dentur u o, i e complementa scilicet laterum y u, y i dabuntur eorum sinus, & proinde ratio u a ad a i. Atq; hæc in utraque figura conveniunt. jam si sint latera y u, y i minora quadrante vel majora sigillatim, ut in prima figura: datur ex thesi differentia arcuum u a, a i nempe i u latus id cuius tanquam basis angulus quæritur. Sin latus unum verbi gratia y i quadrante minus sit, reliquum majus: datur ex thesi summa arcuum i a, a u. Sed jam eorum ratio innotuit. Ergo per 8 e 10. invenietur u a, & a i. jam in triangulo a i, i e rectangulo data basi ac crure i a & i e: dabitur angulus e i a. æqualis trianguli dati angulo i. in prima figura. at in secunda reliquus de duobus rectis est pro quæsito. Et invenietur crura e.

Secundo in triangulo a u o rectangulo nota basi u a ac crure u o invenietur angulus ad u. cujus complementum ad duos rectos est pro angulo ad u trianguli dati in prima figura. Sed in secunda est ipse angulus u. & invenietur etiam a o.

jam in prima figura differentia a o, a e est angulus ad y.

at in secunda summa dictorum arcuum angulū ad y subrendit.

Secunda hujus inventionis methodus est 34. p. 4. ubi angulum in centro investigat æqualem sphærico. Eam retinuit quoq;

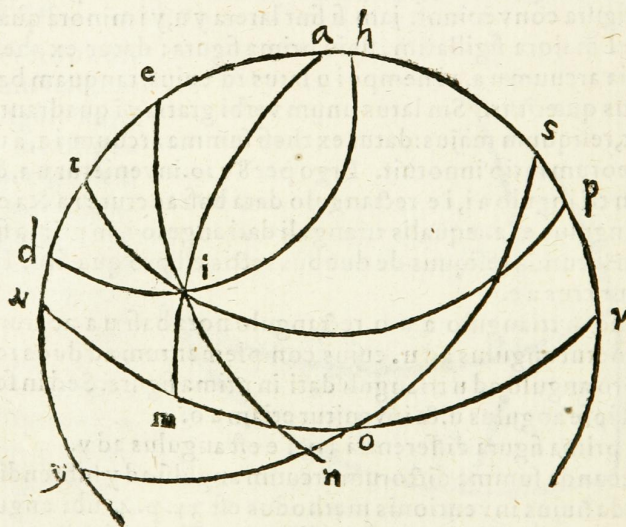
Copernicus

Copernicus 13. theor. 14. cap. l. i. Apud eos hæc via legi potest.

Tertia methodus est ad 3 p 5 ex 2 p 5 theoremate certè in Mathematicis ac Astronomicis magnæ utilitatis. Ac certè in maximis & creberrimis in Astronomia inventionibus adhiberi videmus non tantum à Regiomontano atq; Copernico, & id quidem obscure: sed etiam à junioribus, Nonio Cardano & aliis. Itaq; & nos hic retinebimus tanquam secundum calculi fundamentum. primum enim positum nobis fuit in Prolemaico lem-mate. Atque ut ante Prolemæum audivimus: sic modo Regio-montano nostro attendamus.

30. In triangulo spherico potentia radii est ad planum crurum, ut sinus secundus anguli dictorum crurum ad differentiam sinuum secundorum basis & differentia crurum.

Esto triangulum a e i sphaericum: ex cuius angulis a & e tanquam polis describantur maximi circuli quorum peripheriæ se-



CCAT

Erit ergo te differentia crurum & e d æqualis basi ei.

Hoc ut plenius demonstretur: describatur circulus $y e a s$, in



quo sint communes sectiones circulorum $ya s$ & $yo s$ recta ys :
 circulorum vero $ya r$ & $yo r$ recta ur . rursus communis sectio cir-
 culorum $ie h$ & $di h$ sit recta dh . itemq; circulorum yp & $ti p$
 recta tp . jam radius sphaerae secet tp in q . itemq; radius oe secet
 dh in c . Et sit in radium sinus arcus $a e$ recta am , hoc est uf . Nam
 arcus $a e$ & uo aequantur. Ergo sinus ejus secundus erit em . Et
 baseos ed sinus secundus est ec . Et differentiae crurum e & sinus
 secundus est en . Quare differentia sinuum secundorum basis &
 differentiae crurum est nc , hoc est per 2. c. 6. e. 10. R. est tl .

Rursus ex superioribus illud constat, cum circulus maximus
 $ya p$ secet circulos $ti p$ & $di h$ per polos, bisecare & proinde re-
 ctè secare ideoq; per centrum secare quare communes sectiones
 tp , dh sunt sectionum diametri & proinde q & c sunt eorum
 centra. Hinc & illud sequitur ti esse sinum secundum arcus ti .
 cum enim uterq; circulorum $ti p$ & $di h$ perpendicularis sit cir-
 culo $ye a p$. ut jam patuit: erit eorum communis sectio, quæ per
 punctum i est, perpendicularis circulo $ye a p$ per 10. e. 21. R. &
 proinde perpendicularis diametro circuli $ti p$ per 3. e. 21. R.
 Quare hanc sectionem communem diameter $tq p$ bisecabit:
 eritque bisegmentum sinus arcus ti : & proinde $i t$ sinus ejus se-
 cundus. Quemadmodum hæc in sphaera armillari plenius con-
 cipi possunt.

Abscindatur etiam peripheriæ um sinus secundus ub , è dia-
 metro scilicet circuli $uo r$. jam cū $a u$ & $a m$ maximi circuli secet
 parallelos per polos: segmenta um & ti sunt similia per 24 e. 12.

Ergo per 3 e. 5. ut radius circuli $uo r$, hoc est uo ad radium cir-
 culi $ti p$, hoc est ut jam patuit tq . id est sinum arcus $a t$ vel cruris
 $a i$ dati trianguli, sic ub sinus secundus anguli a ad ti sinum se-
 cundum arcus ti .

Secundo cum triangula ufo , & $tl i$ rectangula, æquentur an-
 gulo $l ti$ & $fu o$ per 4. c. 12. e. 5. R. Quia enim circuli $uo r$ & $ti p$
 paralleli, ex thesi, secantur circulo $ya p$: communes sectiones
 per 14. e. 11. R. erunt parallelæ: & per 12. e. 5. R. tl & uf sunt paral-
 lelæ. Quare anguli $l ti$, $fu o$ sunt anguli crurum alternè paralle-
 larum.

larum. Et proinde per c.3. e.7. R. triangula dicta sunt æquiangula: ac per 9. e.7. R. ut u o radius ad u f sinum cruris e a sic t i ad t l differentiam sinuum versorum basis ac differentia crurum. Quare termini proportionales sic sunt in triangulo proposito.

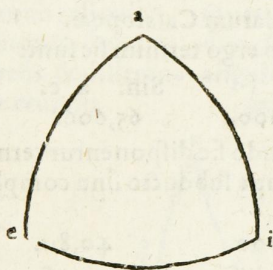
Rad. sin. a i. sin.sec.an. a. sin.sec. t i.
Rad. sin. a e. sin.sec. t i. Differentia &c.

Itaq; per proportionum multiplicationem ut planus radii ad planum sinuum crurum. Sic sinus secundus anguli ad differentiam sinuum secundorum basis ac differentia crurum.

Itaq;

31. In triangulo spherico radius est ad quartum radio sinibus cruris unius itemq; cruris reliqui proportionalem ut sinus secundus anguli crurum ad differentiam sinuum secundorum basis ac differentia crurum.

Esto enim triangulum a e i, erit per præmissum elementum ratio sinus secundi anguli a ad differentiam sinuum secundorum basis e i, & differentia crurum facta ut hic vides.



An. Rad. Rad. Sin.sec. a. Diff.sin.&c.
Con. sin. a i. sin. a e.

Ergo si sit ut radius ad sinum a e sic sinus a i ad quartum: Erunt facientes radius ad sinum a i & a i ad quartum. Ergo, cum heterologi æquantur, ut radius ad quartum inventum, sic sinus secundus anguli a. ad differentiam dictam.

Dd 2 Quare

Quare termini proportionales sic sunt:

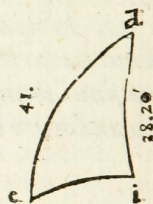
Radius.	sin. cruris.	sin. cruris.	Quartus.
Radius.	Quartus.	sin. sec. a.	Diff. sin. secund.
			Bas. & diff. cru.

Et hinc licet.

32. *Datis anguli dati cruribus, basin ejus invenire.*
28. p. 4. Reg.

Quod si crura sunt æqualia, anguli in basi æquantur per 7 e 13 ideo per 9 e 13. perpendicularis bifecat basin. hinc postularum superius citius tibi satisfaciet.

Sint ergo crura inæqualia: & detur a e gr. 41. a i vero gr. 38. 26. cum angulo a grad. 8. 56. quæ data sunt exempli istius supra allati ex Tychoe & Thaddæo.



Quæritur hinc e i distantia nempe duarum stellarum Cassiopeæ.

Primo ergo termini sic sunt:

Sin. a e.	sin. a i.	
100,000.	65,606.	62,023.
		40,811.

Secundo sic disponentur termini invento sinu secundo anguli a. nempe subducto sinu complementi de radio.

Sin. sec. a.	
100,000.	40,811.
	1,186.
	484.

Ergo differentia sinuum secundorum basis ac differentia crurum est 484.

Hæc ergo differentia addita ad sinum secundum differentia crurum est sinus secundus basis. ut in hoc exemplo sinus secundus differentia crurum gr. 2. 40. est 108. Ergo summa 484 & 108. hoc est 592. est pro sinu secundo basis. i s de sinu toto seu radio relinquit 99,408. cui competit gr. 83. 46'. Ergo ejus complementum gr. 6. 14'. est pro basi quæsita.

Et

Et ex hoc elemento, ut cæteros jam usus taceam, magna Geographiæ auxilia parantur: in quærendis terrestrium locorum distantii: ubi locorum diversa & latitudo & longitudo existit: sic enim Geographi nominant. Et sic inquit P. Nonius libro secundo de observat. Regul. ac instrument. c. 20. Et Cardanus etiam eam ad rem citat 2 p 5 Regiomontani in libris de Varietate rerum. Et nuper in edita à se Astronomia Mæstlinus amicus noster eandem viam ingressus est. Plura tamen hujus theoremaris exempla luculentissima Nonius in libro de crepusculis suppeditabit.

Et

33. *Datis trianguli lateribus, cujusvis basis angulum invenire. 3.p.5. Regiom.*

Inventio ex hætenus dictis non est obscura. Sunt enim in triangulo dato termini huic rei accommodati proportionales hoc modo:

Rad.	sin cruris.	sin cruris reliqui.	Quartus.
Quart.	Radius.	Differentia sinuum	sinus secund.
		Sec. basis & differen-	anguli oppo-
		tiæ crurum	siti basi.

ut si ex datis tribus lateribus

a e.	41.	
a i.	38.	20.
e i.	6.	14.

Quæraturs angulus

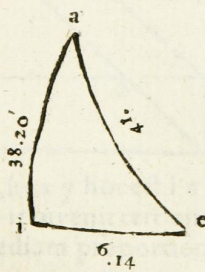
e a i.

Termini ergo proportionales sic sunt:

	1.		
Sin. a e.	sin. a i.		
100,000.	65,606.	62,023.	40,811.

	11.		
		Sin. sec. ang. a.	
40,811.	100,000.	484.	1,186.

Dd 3 Tertius



Tertius terminus 484. est differentia sinuum secundorum basis ei & differentiae crurum. Hunc si basis minor quadrante sit compendio inuenies si differentiam assumes sinuum complementorum basis ac differentiae crurum. Quod Regiomontanus ad 2 p 5 admonet. Sed tamen si basis quadrante maior sit, perinde non inuenietur.

Et sic calculum triangulorum exposuimus. collegimus ea quæ usum habere videbantur: & quibus cognitis omnia ea quæ specialia ab aliis colliguntur tractari & expediri commode possint: nec tantum ea tractari quæ collecta sunt, sed quæ quotidie Astronomis, Geographis aliisque occurrunt & inueniuntur. Nec enim adhuc tot tamq; varii casus collecti

sunt ut ultimum viderimus. Tu iis candide

Lector fruire in suo quisq; proposito exemplo: & studiis

nostris fave.

F I N I S.

ELEMEN



ELEMENTA IN SE.

renda ad quintum Rami sic
sunt restituta.

14. Si due rectæ se secantes parallelis pluribus interse-
centur: parallele conterminis segmentis sunt propor-
tionales.



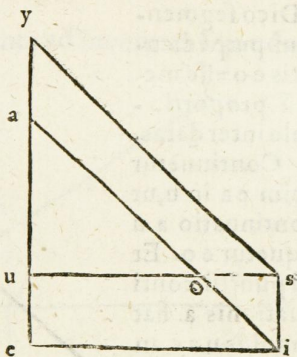
ST è 13 e confectarium. Sint enim rectæ a e, a i in-
tersectæ ad a. Eas secent parallelæ u o, e i. Erit ut
a u ad u o sic a e ad e i. Erigatur enim à termino i pa-
rallæla i s ad a e. & u o in eam continuetur. Tum à
termino s sit ad a i parallela s y. in quam continue-
tur recta a e. Erit a y æqualis rectæ
i s, hoc est u e per 5 c 12 e. Erit tan-
dem per 13 e ut u a ad u o sic a y, hoc
est u e ad o s.

Ergo per compositionem pro-
portionum ut u a ad u o sic u a &
u e ad u o & o s, hoc est e i p 6 c 12 e.

Eadem fuerit demonstratio si re-
ctæ sint verticaliter intersectæ, ut in
eodē diagrammate patet. Si enim
datæ a i & u s intersectæ verticali-
ter in o secantur parallelis a u, s i.
Completa præmissa fabrica erit per
13 e ut a u ad a o conterminum segmentum, sic a y hoc est i s ad
o s conterminum segmentum. Elementum 13 invenit tertiam &
quartam proportionalem: hoc continue mediam propor-
tionalem simplicem aut duplicem suppedirabit.

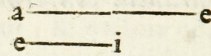
Itaq;

1. Si data due rectæ in unam continuantur: perpendi-
cularis à puncto continuationis in angulum norma conti-
nuatam



nuatam cum continuatione includentis est media proportionalis inter datas.

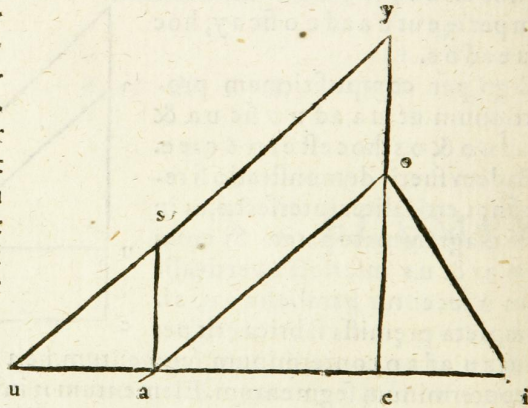
Norma sive gnomon, canon, est instrumentum crurum anguli recti, de qua supra fuit ad 8 e. Ejus opera media datis proportionalis invenitur, unde & Mesolabum seu Mesographus simplex dici posset. Sint datæ duæ rectæ a e, e i.



Quæritur his media proportionalis: ad quā sit ut a e sic e a ad e i. Continuetur ergo a e in i ut continuatio e i æquetur reliquæ datæ. Dehinc è puncto continuationis e erigatur perpendicularis infinita e o. jam circa hanc perpendicularem sursum deorsum, horsum illorsum moveatur norma a o e ut angulo suo comprehendat e o. cruribus vero includat rectam a i.

Dico segmentum perpendicularis e o esse mediū proportionale inter datas.

Continuetur enim e a in u, ut continuatio a u æquetur e o. Et ad punctū continuationis a. fiat angulus u a s angulo o e i æqualis & æquicrurus: hoc est crura s a s fiat æquale cruri e i. Quare connexis u & s. rectæ u s & o i æquabuntur, & anguli e o i, a u s per i. c. 6. e. 3. & per 12 e. s a, o e sunt parallelæ, & angulus s a o. æqualis angulo a o e. Sed & anguli s a e & a o i sunt recti ex fabrica & thesi: & proinde æquales. quare



quare reliqui o a e & e o i, hoc est s u a sunt æquales: & proinde per 12 e u s & a o parallelæ: & u s ac e o continuatæ concurrent. ut hic in y: & per 5. c. 12. e. o y & a s æquantur.

jam per 14 e. ut u e ad u a sic e y, ad a s. Ergo per subtractionem proportionum: ut e a ad u a sic e o, hoc est u a ad o y, hoc est a s.

Et

2. Si data duæ rectæ rectè conterminæ verticaliter continuentur: norma crure suo eiꝯ, parallelo mobili incidēs in terminos datarum, angulis in continuatas, interfecabit e continuatis duas medias continuè proportionales datis.

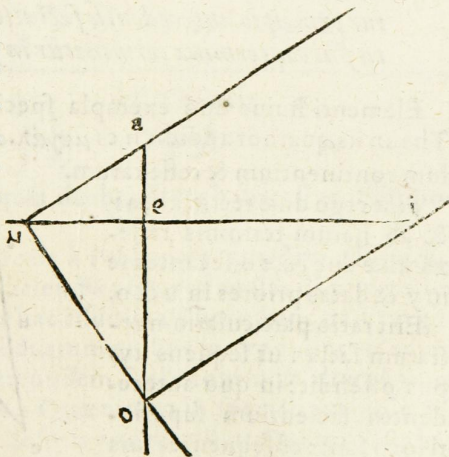
Præmissum confectariū Mesolabii simplicis fuit: hoc duplicis est, cuius usus in fabricandis optatis corporibus est perspicuus.

Sint datæ duæ rectæ a e, e i.

e ——— i
a ——— e

Sintq; inveniendę rectæ media continuè proportionales, nempe ut sit a e ad inventam sic inventa ad inventam secundam, & ut illa ad hanc sic hæc ad e i.

Conterminetur itaq; datæ rectæ ad e. & infinite continuentur sed verticaliter: nempe i e versus u. at a e versus o. jam ad reliquam fabricam Platonis fuit mesographus norma scilicet oppositis cruribus parallela: Ejus crus unū per cavum coterminorum laterū mobile est. Ergo mesographum tibi comparabis: si normæ addas unicum laterus mobile, sed oppo-



E e sito

sito cruri utcumq; motum parallelum: quæ duplex quasi norma est, jam si hæc norma adhibeatur: & tamq; diu latus mobile vol-
vatur ut cum opposito contineat terminos datarum, sed anguli in continuatas incident: rectæ à continuationis puncto in angulos normæ sunt quæ sitæ. ut si Mesographi a u o i latus o i mo-
bile sit: hac illac volves donec anguli u & o incident in infinitas, & simul u a, o i attingant terminos a, i. Erit per confectarium præmissum

ut e i ad e o sic e o ad e u.

ut e o ad e u sic e u ad e a.

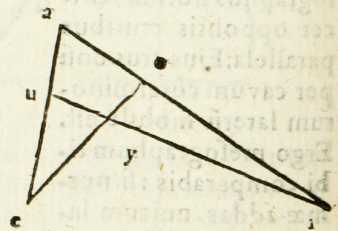
Et sic Mesolabium tam simplex quam duplex expositum fuit: cujus usus fabricis lineati optati est accommodatissimus.

15. Si quatuor rectarum duæ faciant angulum reliquæ ab harum terminis in se reflexæ priores secant: ratio unius ad segmentum suum vel segmentorum inter se fit è ratione ita conterminarum ut prima facientium conterminetur principio antecedentis factæ. secunda hujus consequentis fini contermina terminetur in finem cōsequentis factæ.

Elementi hujus duo exempla specialia Prolemæus habet: Theonius quatuor addidit $\mu\epsilon\gamma\acute{\alpha}\lambda.\sigma\upsilon\nu\lambda\acute{\alpha}\phi$. de alterutra angulum continentium & reflexarum.

Sint ergo duæ rectæ a e, a i & ab harum terminis reflexæ aliæ duæ i u, e o secantes se in y & datas priores in u & o.

Erit ratio particularium rectarum facta: ut sequens typus ostendit: in quo antecedentes facientium superiori loco sunt: cōsequentes suis antecedentibus subiiciuntur.



1. Est

Facientes.		1. Est Ptolemæi & Theonis		1.
		Facta.		
i u.	y e.	i a.	a o.	
u y.	e o.			
		11. Est Theonis		vi.
a u.	e y.	a i.	i o.	
u e.	y o.			
		111. Est Theonis		111.
e a.	u i.	e o.	o y.	
a u.	i y.			
		1111. Est Theonis		11.
o a.	i u.	o e.	e y.	
a i.	u y.			
		v. Est Ptolem.		11. Theonis 1111.
i y.	u e.	i o.	o a.	
y u.	e a.			
		vi. Est Theonis		v.
e u.	a i.	e y.	y o.	
u a.	i o.			

Eodem modo in reliquis duabus series habet: five terminos alternos five invertas.

Pro demonstratione foris à Ptolemæo quædam assumitur: quæ multiplicans duas faciendis proportionales iis proportionales alias inveniatur. De hac assumpta Theon hanc tradit regulam: ut sit parallela alteri duarum quibus interponitur vel adiungitur, vel pars alterius earundem, vel e contra ut altera harum sit pars assumptæ de foris. Quæ tamen in speciali exemplo determinate assumendam de foris non monstrat. Quare relicta hac Theonis regula, ista demonstrationis nobis fabrica sit: ut à principio

Ee 2 cipio

cipio antecedentis factæ parallela consequenti secundæ facientium ducatur in aliquam datarum infinite continuatam.

Erunt tum multiplicatæ proportionēs.

Anteced. Conseq. Anteced. Conseq. secundæ facientium: utrobique æqualitatis ratio.

Anteced. Conseq. primæ facientium, parallela, antecedens secundæ facientium per 14 e.

Ergo per multiplicationem proportionum, ratio parallelæ ad consequentem secundæ facientium, hoc est, ex fabrica & 14 e, ratio antecedentis factæ ad consequentem fit è ratione &c. dicto modo.

Exempli gratia demonstretur exemplum primum speciale.

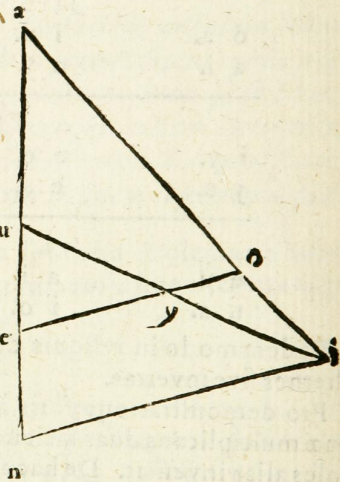
Dico ergo rationem i a ad a o esse factam è ratione i u ad u y per rationem y e ad e o. Ducatur enim à principio antecedentis factæ nempe puncto i parallela rectæ e y. quæ concurrat cum a e continuata in n. Erit ergo per 14 e. ut i a ad a o sic parallela ducta ad e o consequentem secundæ facientium. Sunt ergo jam multiplicatæ proportionēs.

i u. u y. i n. e y. per 14. e.
y e. e o. e y. e o.

Ergo ut factus ab i u per y e ad factum ab u y ad e o sic in ad e o, hoc est i a ad a o.

Sic fit secundum Ptolemæi docendum quod in typo præmisso quintum est.

Dico ergo rationem i o ad o a esse factam è ratione i y ad y u, & ratione u e ad e a. Rursus enim à principio antecedentis factæ i sit parallela ad consequentem secundæ facientium e a. quæ concurrat



currat cum e o in n continuata.
Erit per 14 e. ut i o a d o a sic in ad
e a. Sunt ergo jam rursus multi-
plicatæ proportionēs

ue e a. ue. e a.

i y. y u. i n. ue. per 4. e.

Ergo per multiplicationē pro-
portionum ratio i n ad e a, hoc est
i o a d o a fit ē ratione i y ad y u per
rationem u e ad e a.

Hæc duo exempla Ptolemæus
paulo aliter cum Theone demon-
strat: nec parallelam eodem &
communi modo ducit. ut enim

in primo exemplo à puncto o seu fine consequentis factæ paral-
lela antecedenti primæ facientium ducitur: sic in secundo exem-
plo parallela quartæ e o ē fine consequentis factæ egreditur.

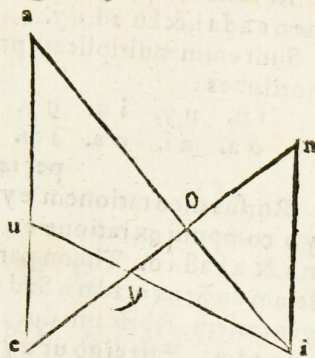
Theon quoq; in suis exemplis speciatim demonstrandis ge-
nerali via caret. Nam in secundo nostri typi exemplo parallela
est à principio antecedentis factæ ad consequentem secundæ fa-
cientium: at in tertio à fine consequentis factæ parallela conse-
quenti primæ facientium educitur. Quare ut de generali elemen-
to sollicitus fui: sic generalem elementi demonstrationem, de-
monstrationisq; fabricam quærere conatus sum. Et sane talis est
ea quam proposui: & in specialibus Ptolemæi exemplis exer-
cui. Sed præstat in Theonis exemplis idem docere. Sumemus
itaq; rationem reflexæ ad segmentum & segmentorum inter se:
nempe 4 & 6 exemplum nostri typi.

Dico ergo rationem o e ad e y esse factam ē ratione o a ad a i
per rationem i u ad u y.

Ducatur à termino o nempe principio antecedentis factæ pa-
rallela ad u y recta n o.

Erit per 14 e. ut o e ad e y sic parallela n o ad u y.

E e 3 At



At ratio o ad uy fit e ratio.
ne o ad ai , & i u ad uy .

Sunt enim multiplicatę pro-
portiones:

i u. uy . i u. uy .
 o a. ai . o s. i u.

per 14 e.

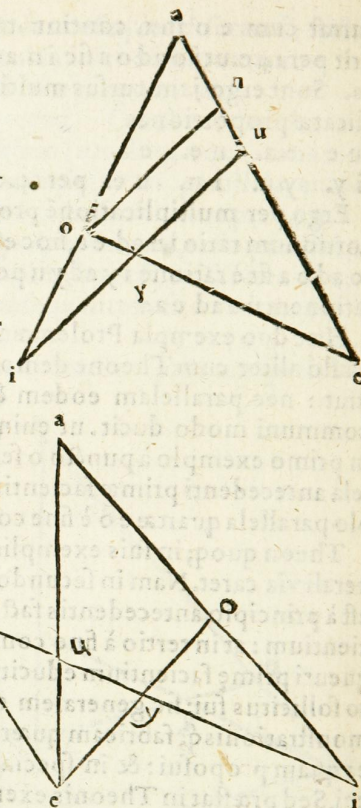
Rursus dico rationem ey ad
 yo componi ex ratione eu ad
 ua , & ai ad io . Theon paral-
lelam ducit ex o . ad ui . Sed per
generalem fabricam ducetur
ex e ad oi . Erit ergo ut ey ad
 yo . sicut ad oi . jam
sunt multiplicatę pro-
portiones istę:

ai . io . ai . io .
 eu . ua . eu . ai .

Ergo ratio en ad io ,
hoc est ey ad yo erit
ex dictis rationibus fa-
cta.

De segmentis recta-
rum diversarum multa
tractant Arabes sub no-
mine regulę sex quan-
titatum. Et Alchindi hac de re modi sive theoremata circumfe-
runtur. Repetit etiam in Algorithmo suo Regiomontanus: &
Maurolycus ad p 3 Menelai. Verum nihil habent quod non
protinus ę proportionum multiplicatione Arithmeti-
cę peritis occurrat. Sunt enim modi illi
istius multiplicationis exem-
pla specialia.

F I N I S.



BASILEÆ,
PER SEBASTIANVM HENRIC-
PETRI, ANNO SALVTIS HV-
MANÆ M. D. LXXXIII.
MENSE AVGV-
STO.

remata circum
giomontanus
habent quod
e Arithmeti-
drilli



I
Artificiosa linearum rectarum dimensio, quæ fit applicati-
one mensuræ datæ, e triangulis similibus originem trahit.
Ideoq; instrumentum ad dimetiendas rectas maxime accom-
modatum tale erit quod in trianguli formam componi
possit, quale hoc nostrum est, quod ob similitudinem
quam cum quodam a Ptolomæo descripto instrumento
Astronomico habet, **REGULAS PTOLOMAICAS**
appellare placuit.

2.
Hoc in instrumento duo considerata veniunt: instru-
menti descriptio, & ejus in linearum rectarum rectam
dimensione usus.

3.
In descriptione instrumenti tamen partes e quibus constat:
tamen ea quæ in illius constructione considerare oportet,
enumeranda sunt.

4.
Partes vel sunt necessitatis vel commoditatis. Neces-
sitaris sunt e quibus instrumentum componitur.

5.
Hæ sunt vel principales vel secundariæ. Principales
partes sunt tres regulæ, circiter tres pedes longæ, in par-
ter æquales distinditæ, quibus dimensio perficitur.
Harum crassior basis reliquæ duæ crura dicantur.

6.
Basis majoris commoditatis gratia cylindracea esto:
ita enim commodius in fistula, a qua sustinetur
instrumentum [de qua usq; 13] circumvolvi potest.

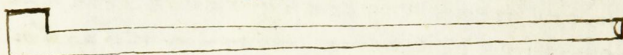
7.
Crura parallela sunt, præterq; in altero termino, in
quo ut basi connecti & circumvolvi queant, præeminen-
tias circulares [capita vulgo vocant] habent.
Ichnographia crurum hæc est.



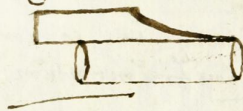
Initium distributionis fiat a centro capitis, circa quod
crus voluitur.

8
Partes secundariae sunt fulcrum crurum basi connexa. Ho-
rum basi immediate connectitur, reliquum mediante fistu-
la.

9
Basi immediate connectitur fulcrum sinistri cruris: quod
binos circiter digitos longum ac latum sit, basi aliquanto
tenuius, cum ad alterum terminum, sinistrum puta,
recte insistit. Ichnographia basis cum altero fulcro,



10.
Fulcrum quod basi per fistulam connectitur est lignum fi-
stulae ex altera parte longius ejusdem cum basi crassitiei.
Ichnographia illius haec est.



11
Est autem hoc dextri cruris fulcrum, ideo per basin sur-
sum deorsum volubile, ut basi tanta, quantum res exigat fieri
posset.

12
Atque haec sunt partes, quae ad conficiendum instrumentum
necessario requiruntur: ex autem qua majoris comodi-
tatis gratia adhibentur, sunt fulcrum sustinens instru-
mentum, & arcus circuli ligneus.

13
Fulcrum instrumenti est baculus quatuor sive pedes longus,
instrumentum demetiendum sustinens, ne ob manus
tremulas aliamve ob causam a vero aberremus, hic
ex altera parte acutus sit, ut terra infigi possit: in
reliqua fistulam habeat, qua basin sustineat immo-
bilem: quod ut commodius fieri possit, rothlea ubi res
exigit sistatur.

14
Arcus circuli lignei, quadrante aliquo major sit, ejusq; radius, semissem pedis circiter adaequet. Hic basi ita infigatur, ut crus sinistrum perforatum circa illum libere volvi, & in inferiori parte, re ita exigente, rotulea sisti queat.

15
In connexione partium instrumenti tria observanda sunt. primum quod centra axium, circa quae crura suis fulcris incumbunt, circumvolvi possunt, æqui distare debent linea in basi distributiva.

16
Alterum est quod centrum axis, circa quem crus dextrum volvitur, debet esse in linea fistulae termino perpendiculari. Hæc n: ratione ex fistula veram basis quantitatem definit: & crus dextrum quoties rex exigit basi perpendicularare fiet, si terminus cruris dextri per centrum capitis continuatur, fistulae initio responderit.

17
Tertium est quod cuiuslibet lateri duæ dioptræ, per quas visus feratur, imponenda sunt. Porro de pinnis basis hoc observandum est, eas non ipsi basi infigendas esse, sed fulcris crurum, & quidem ex adverso centrorum axium. Vera n: trianguli facti basis est linea ductorum axium centra connectens: cui cum data est, ex fistula terminatur, semper æqualis sit, hæc pro illa utimur.

18
Hætenus de instrumenti compositione dictum fuit, reliquum est ut de illius usu in dimetiendis rebus dicamus. Sunt atq; in primis tres dimensionum modi, quorum primus est quarum stationum, in quo mensor mutat locum, reliqui duo sunt quidem simplicis distantie, verum primam dimensionem semper ante se reperiunt.

19.

Prima dimensio est radii optici: hoc est docet invenire distantiam signi propositi ab oculo. Dimensionis huius axiomata hoc est lo. Si visus fuerit per pinnas crurum in signum propositum [cujus distantiam ab oculo investigare cupis] e duabus stationibus, basi intervallo stationum parallela existente, erit ut segmentum basis ad intervallum stationum, sic segmenta crurum ad sibi correspondentia intervalla a stationum locis usque ad signum propositum. Itaque

Si numerus partium segmenti basis aequatur numero pedum vel ulnarum, inter stationum puncta, interceptarum numerus partium cruris cujuscunque quantitate correspondentis intervalli, [sive radii optici] definiet.

Axiomatis explicatio.

Dimensurus puncti alicujus ab oculo distantiam, per locum propositum, alium quendam tibi eligito, eorum distantiam famosa mensura metitor. Deinde conferas te in locum illum, qui magis sinistrum versus situm est [aut si in eodem cum signo dato plano utraq. loca fuerint, in remotiorem te confer] & instrumentum fulvo impositum ita dirigito, ut per pinnas basis parallela intervallo stationum basium secundae stationi infixum, per pinnas cruris sinistri signum propositum cernere possis, quo viso, cum sinistram cornea firmiter sistito, ne translato in secundam statione instrumentum loco moveatur. Tertio basin instrumenti facito tot partium, quot pedum aut ulnarum fuit intervallum stationum, quod si ratione aequalitatis uti non licet, duplam vel aliam, prout commodum visum fuerit, rationem assumito. Quarto confer te in 2^{da} stationis locum, & instrumentum ita dirigito, ut per pin-

nar basis, contermina ac parallela intervallo stationum
barilum a prima statione erectum, per cruris dextrum se-
gmentum propositum videar, quo facto cruris sinistrum di-
stantiam signi propositi a prima sectionis loco, dextrum
a secunda sectione monstrabit, 20. 21. illam rationem qua
inter basin & stationum distantiam fuit.

20.

Secunda dimensio invenit simul longitudinem & altitudi-
nem longitudinem perpendiculararem & conterminam, si tamen
primo per praecedentem modum distantiam termini
altitudinis, ab oculo dimensur fuerit.

Axioma tale est.

Si visus fuerit a termino cruris sinistri [basis longitudi-
ni parallela existente] in terminum altitudinis, erit ut
segmentum cruris sinistri ad radium opticum, per pec-
dens elementum inveniendum, sic segmentum cruris dex-
tri, basis perpendicularis ad altitudinem metiendam:
et sic segmentum basis ad longitudinem.

Itaque

Si numerus partium cruris sinistri aequatur numero pe-
di in radio optico contentorum, numerus partium
cruris dextri altitudinem definiet, numerus partium
basis longitudinem.

Observatio.

Si e loco superiori altitudinem ejus longitudinem con-
terminam metiri cupis, visus per pinnas sinistri cruris
E in conterminum longitudinis, ac tum situs instru-
menti duplex esse potest: Nam vel basis est parallela lon-
gitudini ut antea [quod sane modo uti possumus si firmum
sustinet instrumentum] vel basis est parallela eversa
altitudini [quo modo uti possumus si manu instru-
mentum tractamus] ac tum basis altitudinem, cruris
dextrum longitudinem definit.

Expl.

Explicatio axiomatis.

Dimensurus altitudinem longitudinemque, metitor primo di-
 ctam terminum altitudinis [vel in eversa altitudine lon-
 gitudinis] ab oculo. Deinde basi longitudini parallela
 existente, cruris sinistrum ultro citroque volvito, donec per
 illius pinnas terminum propositum videas, eoque vi-
 so cruris sinistram firmiter sistito, Denique cruris dex-
 trum basi perpendicularare, in basi sursum deorsum vol-
 vito, donec a sinistro crure absindat pariter numero
 æquales distantie signi ppositi ab oculo, quò facto par-
 ter basis longitudinem, cruris dextri altitudinem definient.

¶

Tertius modus metitur tum latitudines tum reliquas rectas
 omnes, quas per præcedentes duos modos metiri non li-
 cet, ut pote inclinatas altitudines etc. Verum prius quam
 ad ipsam dimensionem accedas, necessum est, ut per pri-
 mum modum invenias distantiam utriusque lineæ da-
 tæ termini ab oculo.

Axioma dimensionis hoc est.

Si visus fuerit per pinnas basis & cruris sinistri in
 terminos recta ad metiendum proposita, ut dicta la-
 tera [basis & cruris sinistram] eandem ratiōem distan-
 tiar terminorum rationem habentia, sunt ad sibi cor-
 respondentes terminorum distantias, sic segmentum
 cruris dextri, basin & cruris sinistram connectens
 est ad quantitatem lineæ metiendæ.

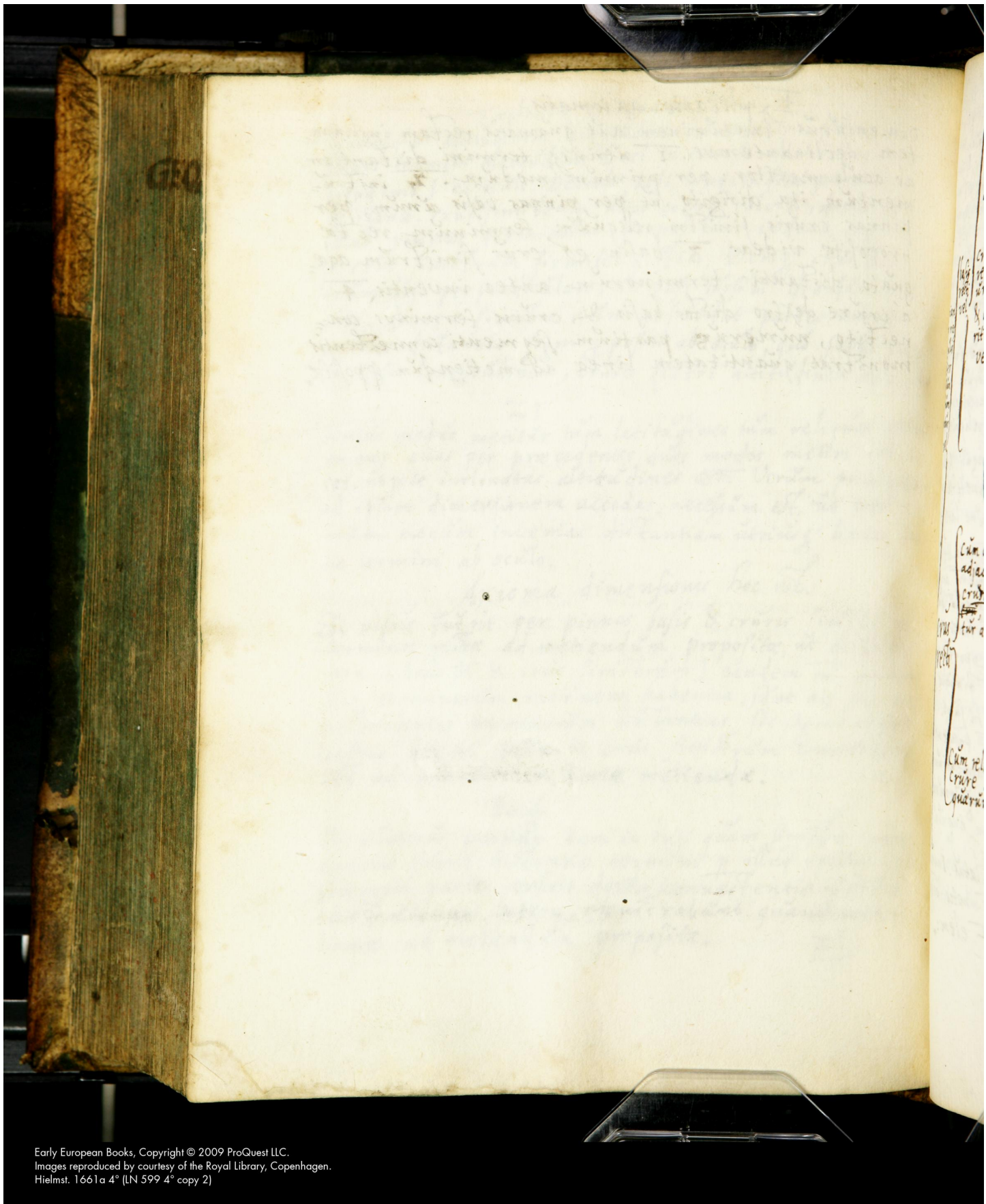
Itaque

Si numerus partium tam in basi quam sinistro crure
 æqualis fuerit distantie termini p illud ipsum lqto
 observati partes cruris dextri connectentis p dicta
 instrumenti latera, monstrabunt quantitatem
 lineæ ad metiendum propositæ.

Ex

Explicatio axiomatis.

Dimensurus latitudinem aut quamvis rectam inclinante
tem declinanteve. *1* utriusq; termini distantiam
ab oculo metitor: per primum modum. *2* Instru-
mentum ita dirigit ut per pinnas basis unum, per
pinnas cruris sinistri reliquum terminum rectae
propositae videas. *3* basis & crur sinistram ada-
quato distantis terminorum antea inventis. *4*
a crure dextro dictos basis & cruris terminos con-
nectito, numerum partium segmenti connectentis
monstrat quantitatem lineae ad metiendam propositae.



Σύνοψις calculi triangulorum.

cum uno acuturum angulorum, & quæritur crur. angulo noto
 oppositum. Inventio est e. 1. confect: r. e. 10 lib: : mensura
: f. p. the
 Ut radius hypoteticus est ad basin recti anguli: sic sinus
 anguli noti est ad crur. angulo noto oppositum.

1 Angulus lateri dato oppositus, Inventio est e. 2. conf:
 r. e. 10 lib: Ut basis in mensura famosa est ad radium:
 sic crur. datum est ad sinum anguli oppositi.

2 Angulus dato cruri adjacens, Inventio est e. 2. conf:
 r. e. 10 lib: Nam ut basis in mensura famosa est ad radi:
 um hypoteticum: sic crur. datum e. ad sinum com-
 plementi anguli inveniendi.

3 Crur. reliquum: Porro ut hoc inveniri possit, quærat
 primus angulus cruri noto oppositus: Deinde quærat
 complementum anguli inventi, hoc definit quanti-
 tatem anguli cruri inveniendi oppositi: Denique
 per basin recti & angulum cruri inveniendi oppo-
 situm quærat crur. dictum: p. 1. q. 1. r. e. 10 lib:

Cum angulo adjacente cruri dato, quæ-
 ritur atq. vel: Crur. reliquum. Inventio est e. 1. q. 1. r. e. 10 lib:
 Ut radius hypoteticus est ad crur. notum
 sic tangens anguli adjacentis crur. notum est
 ad crur. angulo noto oppositum.

Basis recti, Inventio est e. conf: 7 el: ut radi:
 us hypoteticus est ad crur. notum: sic se-
 cans anguli adjacentis crur. notum est ad
 basin recti.

Cum reliquo crure & quæritur: Vel angulus alteri cruram oppositus, Inventio
 est e. 2. confect: 6 el: 10 lib: Ut crur. notum
 e. ad radium hypoteticum: sic crur. reliquum
 est ad tangentem anguli sibi oppositi.

Vel basis recti: Hoc si usq. venit 1 quærat
 angulus alteri cruram oppositus,
 2 per crur. angulum inventum adjacens,
 & per secantem inventi anguli quærat
 basis recti: ut antea dictum fuit.

In trian-
 gulis rec-
 tangulis
 præter
 angulum
 rectum
 dantur
 vel

crur.
 recti

Calculus
triangulo-
rum doli:
quā angulo-
rum est
quādo in-
ter data non
est angulo
rectus. In
hoc calculo
stant vel

Omnia trianguli latera & quārantur anguli. Inventio est ex 9. e
ab angulo opposito. ~~11~~ Hac necessario cadit intra triangulum,
11 el: 2 lib: ~~11~~ tunc. hac est. 1 Latera perpendiculari non
additorum multiplicet per reliquum sub quatuordecim, & facto
latere secto perpendiculari: & reliqui dimidium est mng
3 Per later trianguli minimum & per minus solum
mo & maxo latere inclasi, Inventio est ex 2 glet: 5
hypotheticum: sic segmentum minus est ad sinum com,
4 Eodem modo invenitur etiam complementum reliqui
medio comprehensi, Tertius atq angulus imotesit. 9

Unum trianguli laterum cum oibus angulis & quārantur re-
lateri, est ad laterum notum: sic sinus reliquorum angu-
lateri, est ad laterum notum: sic sinus reliquorum angu-

Duo latera cum angulo opposito
alteri da-
torum
laterum
quāritur
vel
Angulus reliquus noto lateri opposito
anguli noti: sic laterum reliquum est
Laterum tertium trianguli. Actum
per 9 el: 7 Nam: innotescet quod
guli angulis cum uno latere

Anguli reliqui: Inventio est e m
summa reliquorum duorum angulo-
gens. 3 Crura anguli datum
4 Quantur offa inter semissem
5 Per regulam pportionum
foram minor est dimidia sum-
sitam invenitur si sunt. 1
crus alterum. 3 tangens di-
6 Ex tabula tangentium
midia summa angulorum de-
prodeat majorem angulum,
Tertium anguli laterum. Inventio
guli reliquos. 2 notis oibus
laterum per 14 elem:.

patet quodq
lateribus
cum an-
gulo ab-
istodem com-
prehensio:
quāritur
vel

10. lib: Nam I. Ducatur perpendicularis in latus trianguli maxime
 2. Inveniantur segmenta lateris a perpendiculari secti. [Inventio ex
 dividat per latus perpendiculari sectum. 3. Summa laterum
 segmentum usque ad perpendicularem: quo a toto latere detracto rema-
 e: Nam ut latus minimum [quod fit basis recti] est ad radium
 plementi anguli quæsiti
 anguli. Ideo angulus ipse a majore lateris secti segmento & latere
 e: 8 lib: 2. ~~hunc trianguli latus cum duobus angulis~~

liqua latera. Inventio est e' 14 el. Ut sinus anguli, oppositi noto
 lorum sunt ad sibi opposita latera.
 Inventio est ex 13 el. Ut latus angulo noto oppositum est ad sinu
 ad sinum anguli oppositi.

I. Inveniatur angulus reliquo noto lateri oppositus. Ac proinde
 angulus tertius lateri inveniundo oppositus. 2. Datis trian.,
 reliqua innotescunt e' 14 el.

el: Nam I. datus anguli angulus a duobus rectis & relinquunt
 rum. 2. hujus summa dimidium quæritur: ejusque dimidii tan-
 includentia addantur, & semissis summa crurum quæritur.
 summa crurum & crurum alterum.

invenitur tangens arcus illius quo minor angulorum invenien-
 na angulorum inveniendorum. Terminatur per quos quæ-
 semissis crurum. 2. dista inter semissis summa crurum &
 midia summa angulorum.

gratur arcus tangenti inventus comprehendens. Sic si a di-
 brahatur relinquit minorem angulum: si vero eodem addatur

illius hæc e'. I. per precedentem modum quærito angulos trian-
 angulis cum lateribus duobus inveniatur etiam tertium

